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CURRENT CONDITION
OF THE STRATEGIC PETROLEUM RESERVE

HEARINGS
BEFORE THE
SUBCOMMITTEE ON
ENERGY AND MINERAL RESOURCES
OF THE
COMMITTEE ON
ENERGY AND NATURAL RESOURCES
UNITED STATES SENATE
NINETY-SEVENTH CONGRESS
SECOND SESSION

TO REVIEW THE CAPACITY, DISTRIBUTION, AND STATUS OF THE STRATEGIC PETROLEUM RESERVE

MARCH 16 AND 25, 1982

Publication No. 97-105

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CURRENT CONDITION OF THE STRATEGIC PETROLEUM RESERVE

TUESDAY, MARCH 16, 1982

U.S. Senate,
Subcommittee on Energy and Mineral Resources,
Committee on Energy and Natural Resources,
Washington, D.C.

The subcommittee met, pursuant to notice, at 10:05 a.m., in room 3110, Dirksen Office Building, Hon. John W. Warner, presiding.

Present: Senators Warner, McClure, Wallop, Jackson, Matsunaga, and Bradley.

Also present: Roger Sindelar, counsel; D. Michael Harvey, chief counsel for the minority; Benjamin S. Cooper, professional staff member for the minority; and James T. Bruce, counsel for the minority.

OPENING STATEMENT OF HON. JOHN W. WARNER, A U.S. SENATOR FROM THE STATE OF VIRGINIA

Senator **Warner**. Today the Subcommittee on Energy and Mineral Resources begins oversight hearings on the Strategic Petroleum Reserve.

The SPR is looked on by many as a cornerstone in our national defense posture needed to see us through times of energy emergency. Even though the SPR has been in effect for several years, the GAO in a recent report found that the:

> U.S. Government is almost totally unprepared to deal with disruptions in oil imports. Oil import disruptions pose a significant threat to national security, and the lack of effective contingency planning and program development to date is serious and requires immediate attention.

With this problem squarely in mind, Congress recently passed S. 1503 to provide for emergency planning in times of crisis. During consideration of S. 1503, the subject of SPR involvement in emergency plans was raised. However, it was decided that the issue of SPR interaction in any emergency plan should be the subject of further subcommittee hearings.

The hearing today and on the 25th of March will explore this issue and others involving the program.

Mr. Secretary, we welcome you, and you may lead right off.

Mr. **Vaughan**. Mr. Chairman, I have filed a more lengthy statement for the record, and I will try to summarize my statement in these short remarks.

STATEMENT OF WILLIAM VAUGHAN, ASSISTANT SECRETARY FOR ENVIRONMENTAL PROTECTION, SAFETY AND EMERGENCY PREPAREDNESS, DEPARTMENT OF ENERGY, ACCOMPANIED BY RICHARD FURIGA, DEPUTY ASSISTANT SECRETARY FOR STRATEGIC PETROLEUM RESERVE, DEPARTMENT OF ENERGY

Mr. VAUGHAN. The administration appreciates this opportunity, sir, to be here this morning to discuss the strategic petroleum reserve program.

With me is Mr. Richard Furiga. the new Deputy Assistant Secretary for the strategic petroleum reserve. Mr. Furiga was appointed to head the SPR on January 9 of this year, upon the resignation of Mr. Harry A. Jones.

Because of the support received from the Congress and the administration, the availability of oil storage capacity, and favorable oil market conditions, we were very successful in expanding the Reserve during calendar year 1981. Specifically we added 122.5 million barrels, more than doubling the reserve inventory.

Second, we exceeded an average daily fill of 300,000 barrels per day for 7 months last year, with a highest rate of some 513,000 barrels per day being achieved during May.

The majority of the oil acquired was from a continuous open solicitation, taking advantage of the favorable spot market conditions which prevailed during this period. Most of the remaining deliveries resulted from the 5-year contract we recently signed with Petroleos Mexicanos. As of March 15, 1982, the strategic petroleum reserve contains 243.4 million barrels of crude oil, and has a maximum drawdown capability of some 1.7 million barrels per day. We expect to have an oil fill of 250 million barrels this April, and expect to meet or exceed our plan for 267 million barrels in storage by the end of this fiscal year.

Since we have now contracted for most of the oil we had planned to have delivered to permanent SPR facilities for the remainder of this fiscal year, we have temporarily deferred accepting further offers under the continuous solicitation. In coming months, we will again accept offers for short-term delivery as new storage capacity becomes available. We also plan to solicit long-term contracts later this year for use in filling phase II, storage capacity, during fiscal year 1983.

Construction of surface facilities was completed on phase I sites in 1980, and on phase II sites in 1981. Phase II caverns was initiated at Bryan Mound in 1980, and at West Hackberry in May 1981. Approximately 50 millicn barrels of gross cavern volume have been created in the phase II caverns and fill of phase II has begun. We are injecting oil into several phase II caverns at Bryan Mound. While development of two of the phase III sites is continuing, a proposed deferral of fiscal year 1982 budget authority for Big Hill land acquisition and long-lead equipment to fiscal year 1983 has been submitted to the Congress. This will result in completion of the 750 million barrels by 1990 rather than 1989.

The slippage in the Big Hill development schedule represents a tradeoff between near-term Federal budget limitations and our long-term emergency preparedness objectives.

The fiscal year 1983 budget request for SPR is $2,316,178,000. Of this, some $2,074,060,000 is for the off-budget strategic petroleum reserve account. Some $242,118,000 is for on-budget facilities development, operations, planning, and program direction. Specifically, we are asking for $2,074,060,000 for crude oil acquisition, or 53 million barrels beginning the cumulative purchases, bringing the cumulative purchases to 389 million barrels, of which 343 million barrels will be in storage by the end of fiscal year 1983.

We are asking for $222,528,000 for facilities development and operation which will provide for continuation of phase II cavern development, phase III construction at Bryan Mound and West Hackberry, and for the continuing engineering, operation, maintenance, safety, reliability, and security upgrade program.

We are asking for $8 million for planning, and finally, $11,590,000 for program direction to provide for salaries and expenses.

There were several specific concerns that the subcommittee indicated in its invitation letter. I have addressed those in my statement submitted for the record.

Very briefly on the subject of interim storage, we are investigating the advisibility of acquiring oil in advance of permanent storage capacity by securing interim storage capacity. However, we do not have firm plans at this time. The Secretary of Energy has advised the Congress that the Department will be submitting its report on the size of the reserve by May 1. An expanded analysis is being done that reflects current views on world oil prices.

I also want to assure you that we intend to implement the strategic petroleum reserve program with an open mind and willingness to consider serious proposals for alternate storage options. By the same token, any alternative must be consistent with our goals of having a strategic petroleum reserve that is located in close proximity to the existing petroleum distribution system, that is compatible with refining capabilities, and that provides the most value for the taxpayer's dollar.

We are pleased with the accomplishments of the program over the past year and hope that we will receive continued support from the Congress and specifically from this committee.

At this point, Senator, I would welcome your questions.

[The prepared statement of Mr. Vaughan follows:]

STATEMENT OF WILLIAM A. VAUGHAN

ASSISTANT SECRETARY FOR ENVIRONMENTAL PROTECTION, SAFETY
AND EMERGENCY PREPAREDNESS
DEPARTMENT OF ENERGY
BEFORE THE
COMMITTEE ON ENERGY AND NATURAL RESOURCES
SUBCOMMITTEE ON ENERGY AND MINERAL RESOURCES
U.S. SENATE

MARCH 16, 1982

INTRODUCTION

Mr. Chairman and members of the Subcommittee, it is my pleasure to have this opportunity to appear before you today to discuss the Strategic Petroleum Reserve (SPR) program. I am accompanied today by Mr. Richard D. Furiga, the Deputy Assistant Secretary for the Strategic Petroleum Reserve. Mr. Furiga was appointed to head the Strategic Petroleum Reserve on January 9, 1982, upon the resignation of Mr. Harry A. Jones.

SPR Oil Acquisition Activities

I am pleased to report that we have made a great deal of progress over the past year in filling the Reserve. The Strategic Petroleum Reserve presently (as of March 8, 1982) contains 242.5 million barrels of crude oil and has a maximum drawdown capability of 1.7 million barrels per day.

The total fill for calendar year 1981 was 122.5 million barrels, resulting in a cumulative fill of 230.3 million barrels by the end of 1981, which doubled the Reserve inventory from the December 1980 level. We exceeded an average daily fill rate of 300 thousand barrels per day for seven months last year with the highest rate of 513 thousand barrels per day achieved in May.

Several methods were used to acquire SPR oil during 1981.

- 88 million barrels were acquired under a continuous open solicitation, taking advantage of the favorable spot market conditions which prevailed during this period.

- 24 million barrels were acquired under a commercial contract with Petroleos Mexicanos (PEMEX) in 1981. This contract also calls for deliveries of 50 thousand barrels of oil a day from January 1982 through August 1986.

- 2 million barrels were purchased through a competitive solicitation for long-term supply contracts.

- 7.5 million barrels were delivered under the Naval Petroleum Reserves (NPR) exchange agreements entered into in 1980 and from an NPR contract settlement.

- 1 million barrels of Alaskan North Slope crude oil were delivered to the SPR as part of a final settlement of a Consent Order.

In reflecting on the factors which contributed to the SPR's oil acquisition success over the past year, there were a number of necessary ingredients: (1) the policy impetus and sustained support at the top levels of the Administration; (2) availability of oil storage capacity which had been left unfilled at the time this Administration took office; (3) favorable oil market conditions; and (4) Congressional approval of nearly $5 billion in appropriations requested by President Reagan since he took office.

For the remainder of FY 1982, we have an additional 24.5 million barrels under contract and scheduled for delivery. This will increase our cumulative SPR inventory to 267 million barrels at the end of FY 1982.

Since we now have contracted for most of the oil we plan to have delivered to SPR facilities for the remainder of this fiscal year, we have temporarily deferred accepting further offers under the continuous open solicitation. Later this year we will again accept offers for short-term delivery as new storage capacity becomes available. We also plan to solicit contracts later this year for deliveries of oil to fill Phase II storage capacity during fiscal year 1983.

Facilities Development and Operation

As you are aware, the SPR program is being developed in three separate phases to provide a total of 750 million barrels of capacity.

Phase I consists of 250 million barrels of storage capacity at five sites - Bryan Mound in Texas; and Bayou Choctaw, West Hackberry, Weeks Island and Sulphur Mines in Louisiana. It also includes construction of a government owned terminal facility at St. James, Louisiana. Construction was completed on these sites in 1980, and we expect to complete actual oil fill of Phase I storage in FY 1982.

Under Phase II, we will gain an additional 290 million barrels of storage by expanding three existing Phase I sites. Bryan Mound is being expanded by 120 million barrels, West Hackberry by 160 million barrels and Bayou Choctaw by 10 million barrels. An existing storage cavern will be acquired for the additional capacity at Bayou Choctaw. New caverns will be created at Bryan Mound and West Hackberry through solution mining. Construction of all Phase II surface facilities was completed in 1981.

Leaching of Phase II caverns was initiated at Bryan Mound in 1980 and a West Hackberry in May 1981. To date approximately 50 million barrels of gross cavern volume have been created in the Phase II caverns and we have begun injecting oil into the seven caverns which are available for oil fill at Bryan Mound. Acceleration of cavern development is being achieved through an increase of the leaching rate, which required modification of the brine disposal permit. This permit was granted last August by the Environmental Protection Agency. The increased leaching rate will provide 47 million barrels of additional storage capacity by the end of 1985 over the projections in the FY 1982 budget.

Phase III involves the further expansion of Bryan Mound and West Hackberry by an additional 70 million barrels and development of a new 140 million barrel site at Big Hill, Texas. The Big Hill site, as currently planned, will include fourteen new caverns and the necessary surface facilities, and when filled will increase the SPR drawdown rate to almost 4.5 million barrels per day. The Final Supplemental Environmental Impact Statement for SPR Phase III Development was published in October 1981, with the Record of Decision issued in January 1982. Detailed design was initiated in 1981, and Phase III construction will commence at Bryan Mound in 1982.

A proposed deferral to FY 1983 of FY 1982 budget authority for Big Hill land acquisition and long lead equipment has been submitted. As the result of an Administration decision to delay completion of the 750 million barrel system by one year, to 1990 start of Big Hill construction is to be delayed one year, until 1984. This delay will have no effect on storage until 1987. Detailed design, however, will continue in FY 1982.

FY 1983 BUDGET REQUEST

Summary

The President's FY 1983 budget proposes a total of $2,316,178,000 in appropriations for the Strategic Petroleum Reserve. Of this total, $242,118,000 is for the on-budget Strategic Petroleum Reserve account to be used for storage facilities development and operations, planning, and program direction, and $2,074,060,000 is for the off-budget SPR Petroleum Account. A further element of the President's FY 1983 budget is the proposed deferral of $52,860,000 in FY 1982 appropriations for certain Phase III development activities.

During FY 1983 we will continue to fill the Strategic Petroleum Reserve to the full level of storage capacity as it becomes available. We expect to fill the SPR at an average daily fill rate of about 209 thousand barrels per day which would increase the cumulative fill level to 343.1 million barrels by the end of FY 1983.

Off-Budget Appropriation for Petroleum Acquisition and Transportation

The President's FY 1983 budget proposes an appropriation of $2,074,060,000 to the off-budget "SPR Petroleum Account" established pursuant to the Omnibus Budget Reconciliation Act of 1981. Fifty-three million barrels are planned for purchase from the proposed FY 1983 appropriation, about 7 million barrels of which will be delivered in FY 1983, with the remaining 46 million barrels planned for delivery in FY 1984.

Since our existing appropriations through FY 1982 will permit contracting for a cumulative 336 million barrels, we are nearly in a position to fill the SPR storage capacity through the end of FY 1983 using only FY 1982 and prior year funding.

The substantial purchasing power of our FY 1982 and prior year funds explains why the further appropriations proposed for FY 1983 are significantly below the FY 1982 budget authority level. Actual outlays are expected to be approximately the same in FY 1982 and FY 1983, in the range of $2.8 billion in each year. As provided by the Omnibus Budget Reconciliation Act of 1981, these outlays are not counted within Federal budget totals.

Facilities development

The FY 1983 budget request for facilities development and operations is $222,528,000, an increase of $51,172,00 over the FY 1982 appropriation. With respect to facilities development, the proposed FY 1983 budget updates the baseline schedule for leaching new storage capacity primarily due to the decision to increase the leaching rate at the Bryan Mound site. The proposed FY 1983 budget will permit completion of Bryan Mound Phase III construction and continued development of West Hackberry. As a result of these actions, we are now projecting a cumulative oil storage capacity of 456 million barrels by the end of FY 1985, an increase of 47 million barrels from the 409 million barrel projection for FY 1985 associated with the FY 1982 budget baseline. The deferral of funding for long-lead equipment purchases and real estate acquisition for the Big Hill Phase III site from FY 1982 to FY 1983, is the result of a decision to delay completion of the 750 million barrel system from FY 1989 to FY 1990. In the context of the Administration's policy of fiscal restraint, the reconfiguration of the SPR facilities development schedule represents the Administration's decision to focus SPR resources on the near-term (e.g. pre-1985) period when we are relatively more vulnerable. The one-year delay in initiation of Big Hill construction will reduce outlays by $175,000,000 in FY 1983 and FY 1984 while having no effect on storage capacity until 1987. At that point, the SPR will be more than two-thirds filled and the nation considerably less vulnerable to supply disruptions.

Non-Phase Specific

This funding category was established several years ago to finance SPR facilities requirements which are not directly associated with specific phases of SPR development. For FY 1983, a total of $86,728,000 is proposed for Non-Phase Specific activities, including Continuing Engineering ($8,648,000), Operations and Maintenance ($37,345,000) and Safety, Reliability, and Security Upgrades ($40,735,000).

Continuing Engineering activities in FY 1983 will remain at approximately the FY 1982 level and are required to identify and resolve technical problems, maintain an accurate definition of the SPR system and promote an integrated system approach to SPR development activities.

Operations and Maintenance activities will be required for the duration of the SPR program but are particularly intensive during the period of facilities development and fill. Some operations and maintenance activities are funded within specific Phases, particularly those directly associated with storage cavern development. Others are funded through this Non-Phase Specific activity. The increase in budget authority proposed for FY 1983 reflects a combination of our ongoing reestimation and definition of operations and maintenance requirements plus the particular manner in which funding for these requirements is distributed among budget line items.

The Safety, Reliability and Security Upgrades program is an ongoing effort to modify existing SPR facilities from the original design criteria to new and more stringent criteria which emphasize safety, reliability, and security and provide more assurance of readiness of the SPR system for drawdown. A backlog of these projects has developed and the increase in funding in FY 1983 is intended to reduce this backlog and enhance system performance capabilities.

SPR Distribution

The current SPR Distribution Plan, which became effective November 15, 1979, following Congressional review, details alternative methods for drawing down and distributing SPR oil, through price competition, or at a set or market price, either within or outside of regulatory programs.

It is the Department's position that it is neither practicable nor desirable to prepare in advance a more specific plan for the rate, amount, and timing of drawdown, or the method of oil distribution. Rather, any plan should permit reasonable flexibility for SPR use in order to deal with a range of disruptions. Since it is unlikely that we will know the length and severity of a disruption at the outset, rigid plans to draw down and distribute the SPR oil make little sense. We are preparing a Distribution Management Manual that will specify the management and administrative activities that precede and control the SPR drawdown operations. I can assure you that the SPR is physically prepared to draw down in the event of a severe energy supply interruption.

Planning for Increased Capacity

Over the past year, we have evaluated approximately a dozen alternatives for permanent SPR facilities configurations and schedules. During this period, the potential for acquiring the use of private facilities to store additional quantities of SPR oil on an interim basis has been raised, both by the Congress in the committee reports on the Omnibus Budget Reconciliation Act of 1981 and by the private sector in Congressional testimony and studies. Development of additional salt caverns, development of new steel tank storage facilities, chartering tankers for temporary floating storage, and leasing existing on-shore private sector facilities have all been raised at various times as potential SPR program enhancements.

We have concluded that even with major increased near-term investment in permanent SPR facilities development, including the use of above-ground steel tanks, we would not realize a measurable increase in SPR storage capacity until the middle of the decade when we will already be approaching 500 million barrels in cumulative fill. We intend to implement the SPR program with an open mind and willingness to consider serious proposals for alternative storage options. However, enhancements to our permanent storage facilities in terms of schedule acceleration, as distinguished from increased temporary storage, are essentially unrelated to our ability to meet the 300 thousand barrel-per-day fill rate target in the Omnibus Budget Reconciliation Act in the 1982-1983 period or to take advantage of current oil market conditions.

To accelerate near-term SPR fill beyond the rates provided for in the President's budget would require use of existing private sector storage on a temporary basis. Now that we have contracted for nearly all the planned SPR deliveries for fiscal year 1982, we plan to again look at the advantages and disadvantages of such interim storage. Among the factors we will be considering will be the need to maintain balance among costs, availability of interim storage capacity, oil purchase opportunities, and both the level and distribution of budgetary resources between the off-budget SPR Petroleum Account and the on-budget account.

CONCLUSION

In summary, we think that the accomplishments of the SPR program over the past year, and the initiatives proposed by the President's budget for the coming year merit the continued support of the Congress. I am personally convinced that we are making great strides toward the development of a reliable and well-managed SPR system which represents a significant national security resource.

Senator WARNER. The off-budget financing system authorized by the Congress last year has apparently worked satisfactorily?

Mr. VAUGHAN. Yes, sir.

Senator WARNER. Just out of curiosity, what did you have to pay on an average for your money that you borrowed?

Mr. VAUGHAN. We can get that.

Mr. FURIGA. It is the normal Treasury borrowing rate.

Mr. VAUGHAN. The normal rate.

Senator WARNER. The normal Treasury rate; that is very interesting. We certainly wrestled with that for a long time.

For the benefit of the committee members, would you explain how a salt cavern or dome is prepared for the receipt of SPR oil?

Mr. VAUGHAN. Senator, I am going to ask Mr. Furiga to specifically describe that for you.

Mr. FURIGA. In our phase II caverns, Senator, the process simply is to drill your hole in the salt formation. Once you have your hole in place, your casing set and your stringer set, it is a process of injecting fresh water into the salt formation which dissolves the salt, creating capacity. The brine that is generated by the fresh water and the salt is disposed of into the Gulf of Mexico.

A rule of thumb is that it takes seven barrels of fresh water into the salt formation, seven barrels of brine out, to create one barrel of oil storage capacity.

Senator WARNER. One barrel of volume space; I was reading about this with great interest last night. Then you put an inner coating?

Mr. FURIGA. No, sir. The first thing you do when you start leaching is you leach out a sump at the very bottom of the cavern, and you leach what you call a chimney which is the center part of the cavern, and then you roof. It is very important to keep your roof intact.

Senator WARNER. Of your structure.

Mr. FURIGA. You start injecting oil because you want no more leaching occurring in that area. Then it is a matter of placing your stringers, injecting the fresh water to develop your cavern shape. There is no need for any coating inside the cavern itself.

Senator WARNER. What about any geological formations that would enable the oil to escape? How do you insure against that?

Mr. FURIGA. The caverns are tested and certified, we run sonar surveys on the caverns to check out the shape. The caverns are pressurized so that any drop in pressure tells you that they are losing something.

Senator WARNER. How long will that last?

Mr. FURIGA. The caverns are designed, if I can talk in terms of drawing down, for five complete cycles.

Senator WARNER. I understand that.

Mr. FURIGA. Before they coalesce. Even if they coalesce, there is no particular danger or safety consideration. You have the same kind of crude oil in two caverns. If they coalesce, you just have one large cavern. You still can get your oil out.

Senator WARNER. What are the advantages of a salt dome over the storing in steel tanks?

Mr. FURIGA. I would view them as cost and security. These are probably the two primary reasons for underground storage.

Senator WARNER. In your statement, Mr. Secretary, you indicate that the DOE will again accept offers of a short-term delivery of oil for SPR when new storage capacity becomes available.

When and how much new capacity would be added during 1983, fiscal 1983?

Mr. FURIGA. Since we are filling to capacity, that is our program; at the end of fiscal year 1981 we had 199 million barrels in storage. We will be going to 267 million barrels at the end of 1982, and at the end of 1983 our inventory will be 343 million barrels. So we are adding the difference between the 343 million and the 267 million during fiscal year 1983, and that is how much storage capacity we will be creating since we are filling to capacity.

Senator WARNER. Secretary Edwards in response to different questions stated that his department is developing an SPR logistics distribution plan necessary for the effective distribution and sale of the SPR oil.

What is the status of that plan?

Mr. VAUGHAN. Senator, the plan for SPR distribution was developed by our predecessor in the previous administration and was filed with the Congress in 1979 if my recollection serves me correctly. That plan meets the legal requirement in the Department's judgment for a strategic petroleum reserve drawdown plan.

We are constantly looking at that and considering whether or not any amendments or changes are needed. That is what I believe Secretary Edwards meant when he referred to development of the plan. It is not a standing plan.

Senator WARNER. I am going to return to that point because I think we have got to fairly explore that, but at this time I will turn to Senator Jackson.

Senator JACKSON. Mr. Vaughan, as you know, I have been concerned for a long, long time about the SPR, in fact ever since the committee initiated the legislation. I was very pleased with the initiative undertaken at the outset by the Reagan administration. They moved faster than the previous administration, and we had a good fill rate.

I guess my concern now is that the proposed budget cut that is being made from what we are now spending is all together too severe. Currently I think our appropriation is running $3.9 billion, $3.9 billion for the current 1982 budget, and you are down now to $2.1 billion in the proposed budget for fiscal year 1983. The committee has recommended, Mr. Chairman, an add-on of $1.6 billion.

In addition, it is my understanding that the facilities part of it will remain as is. That is, you have got $200 million in fiscal year 1982 and $242 million for 1983.

Now for what it's worth, I can only say to you that I think we are in a state of euphoria that is not going to last long, and I can't think of a more dangerous situation than we have right now currently in the Middle East, Mr. Chairman. The Wall Street Journal had a good piece on the situation as it pertains to Iran, and I made a statement on it and included the article on February 24, and I would like to have that placed in the record if I might.

Senator WARNER. That's a very good suggestion.

[The statement and article follow:]

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Vol. 128 WASHINGTON, WEDNESDAY, FEBRUARY 24, 1982 No. 15

Senate

THE OIL GLUT MIRAGE

Mr. JACKSON. Mr. President, today's Wall Street Journal carries an alarming article about developments in the Middle East. The article details recent escalation of the border war between Iran and Iraq, and highlights the involvement of outside forces, particularly the Soviet Union.

I have commented on this situation numerous times, including a statement I made on this floor just before the recess on Thursday, February 11. At that time, I observed that few would dispute that the Middle East is still a cauldron of instability. Today's article confirms that statement.

Mr. President, all of America's eyes were riveted on the Middle East, particularly Iran, while the hostages were still being held captive. Since that time, the crisis atmosphere has abated and many Americans have been lulled to sleep. We seem to be letting down our guard, principally due to a temporary surplus in oil production.

I have said repeatedly that even though our own dependence on Persian Gulf oil is declining—due to conservation and the recession—our dependence will continue for the foreseeable future. Our allies are in even worse shape, particularly those who do not have domestic energy production. The fate of the Western economic system, and the stability of our political systems, are inextricably tied to the Middle East.

We cannot afford to ignore these events. They will eventually have very serious repercussions. The oil glut is a mirage, as is the temporary respite from conflict in the Middle East.

Unfortunately the administration appears to believe in mirages. They are cutting back on the budget for the strategic petroleum reserve at a time when they should be increasing it.

As I have said before, I applauded the administration's efforts on SPR for the first year they were in office. They averaged an SPR fill rate of 292,000 barrels per day in fiscal year 1981, a commendable achievement. But the budget before the Congress right now falls short of what is needed.

Congress has set a target for the SPR fill rate of 300,000 barrels per day. The law requires the President to "seek to fill" the strategic petroleum reserve at that rate. It would certainly be possible to purchase oil at that rate given the current would oil market conditions. In fact, now is the perfect time to accelerate purchases.

Instead, the fiscal year 1983 budget proposal will set the SPR program back an entire year. It calls for completion of the program in 1990, rather than 1989 as was planned. The President's budget proposes to defer 28 percent of fiscal year 1982 facilities construction funding. OMB cut the DOE request for facilities construction funds by more than half. The oil procurement funding request represents a cut of 44 percent from last year.

Oil prices are declining. Oil is available. Yet they are cutting back on what is unquestionably a national security program.

Yesterday, the Secretary of Energy attempted to appease the members of the Energy Committee by telling us that the fill rate for fiscal year 1983 will be higher than that for fiscal year 1982. What he neglected to point out is that all but 20,000 barrels per day of the oil to fill the SPR in fiscal year 1983 will be purchased under long-term contracts with fiscal year 1982 funds. As a result, the administration's course of action will lead to a precipitous drop in the fill rate by 1985. The projected fill rate for fiscal year 1985 will plummet to 107,000 barrels per day. I simply cannot support that policy.

I hope that the article will be of interest to my colleagues. I ask unanimous consent that it be reprinted at this point in the RECORD.

There being no objection, the article was ordered to be printed in the RECORD, as follows:

[From the Wall Street Journal, Feb. 24, 1982]

Ascendancy of Iran In Conflict With Iraq Imperils Mideast Oil

(By Youssef M. Ibrahim and Karen Elliott House)

A steady escalation of the border war between Iraq and Iran is reviving fears among neighbors and in the West that the 17-month-old conflict may spread—an eventuality that could disrupt oil supplies from the Persian Gulf and bring a swift end to the current world oil glut.

The fears are based largely on two developments, the first being that Iran began in September to gain the upper hand. The second is that the Soviet Union is taking advantage of Iran's near bankruptcy. The Russians have dramatically expanded their presence in Iran and recently signed a cultural-exchange agreement with the Islamic revolutionary regime of Ayatollah Ruhollah Khomeini. Trade between the Soviets and the Iranians is growing.

"The Soviet pause for appraisal of this adminstration is over, and we're now going to be tested," says Eugene Rostow, director of the U.S. Arms Control and Disarmament Agency. "I believe Iran is the place we're going to be tested."

Until recently, Western nations have paid little attention to the Iraq-Iran war. Oil has been plentiful, and the U.S. has little influence with Iraq and none with Iran. Moreover, pivotal oil producers in the region, such as Saudi Arabia, Kuwait and the United Arab Emitrates, have been content to see the two biggest powers in the Persian Gulf preoccupied with what appeared to be an endless war of attrition.

Today, however, the situation in the Persian Gulf is "markedly different," says Adeed Dawisha, a Mideast expert with the Royal Institute of International Affairs in London. He explains: "Iran hasn't only survived, the war, but it is emerging stronger. Secondly, they are actively trying to export the revolution in many concrete ways to their Arab neighbors. This is pushing the Arab oil producers to actively support Iraq."

COUP ATTEMPT

Iran's attempts to export its revolution date from the early days of the Ayatollah's regime but were dropped for a long period because of preoccupation with internal affairs. Such activity was resumed late last year. In October, for example, Saudi Arabia expelled dozens of Iranian pilgrims from Mecca after the Iranians staged political demonstrations aimed at arousing other Moslem worshipers. Then, in mid-December, a band of Iranian-trained revolutionaries attempted a coup in the tiny, conservative Arab sheikdom of Bahrain, a stone's throw from Saudi Arabia. Although both Iranian actions were failures, the conservative Arab regimes of the Middle East began to adopt tactics to curb Iran.

In Jordan, King Hussein is rounding up volunteers to fight alongside Iraq. Egypt is sending military supplies to Iraq and hinting that Egyptian soldiers would join the fight against Iran if the latter's troops set foot on Iraqi soil. Kuwait is offering logistical help, and the United Arab Emirates and Jordan continue to make their ports available to landlocked Iraq.

Since the war began in September 1980, a huge campaign of grants and loans has channeled an estimated $20 billion to Iraq from Saudi Arabia, Kuwait and the UAE. Several more billions are expected this year. Such outlays are described by Arab officials as an unprecedented drain on the region's oil revenues.

Still, Iraq appears in real danger of suffering further military humiliation at the hands of Iran, which is sending waves of new, young recruits to the front in record numbers. "They have Islam in their eyes and a rifle in their hands," says a U.S. official speaking of the zealous Revolutionary Guards, who make up the bulk of Iran's assault troops.

TEHERAN'S DETERMINATION

Iran's goal goes beyond taking back the sliver of land that Iraqi troops have occupied in the Iranian oil province of Khuzinstan. Teheran is determined to topple Iraq's president, Saddam Hussein, and replace his secular Arab socialist government with an Islamic Shia regime similar to that of Iran. Since last September, Iranian troops have taken back land occupied by Iraq near the large city of Abadan. More importantly, the Iranians are coming closer to the Iraqi borders at several points, forcing Baghdad to commit more men to battle and to abandon its policy of avoiding too many casualties for fear of a serious backlash among the Iraqi populaton.

All this comes at a time when Egypt's new government is struggling to root out Islamic fundamentalists and when Syria's president, Hafiz al-Assad, is fighting a tough battle with the fundamentalists in that nation. An Iranian victory could give fundamentalist movements throughout the Middle East new impetus to take on established governments. Such conflicts and the resulting instability would be certain to disrupt the region's vital oil supplies.

Meanwhile, Iran is becoming more dependent on Soviet-bloc aid. Iran has been unable to sell much of its dwindling oil production because of the world-wide oversupply and because of the war risks that keep many buyers away from its Persian Gulf loading stations. The Iranians are therefore resorting to bartering almost half their crude exports—a meager 500,000 barrels a day—for essential goods and services from the Soviet Union and other Communist countries, including Romania, East Germany and Yugoslavia.

Soviet arms continue to flow to Iran under agreements originally concluded with the late shah's regime. Soviet experts are flocking back in growing numbers to work on Iranian industrial projects interrupted in the three years of the revolution, and many new commercial contracts have been signed with Soviet-bloc nations in the past few weeks. Significantly, the Iranian regime seems to have abandoned its public posture of neutrality with the Soviets. Iran's press widely reported a series of recent meetings held by the Russian ambassador to Iran with the Iranian foreign minister, prime minister and deputy foreign ministers; the Iranian officials reported details of the meetings to the Ayatollah Khomeini, but the subject matter wasn't made public.

Most worrisome to officials in Washington are Soviet military activities around Iran. For the past two years, U.S. officials assert, Moscow has been beefing up its troops along Iran's borders—a buildup that appears so alarming to Washington that an administration official recently described it as "the most menacing development in the Near East."

Furthermore, intelligence sources in Washington and London agree that the Iranian Tudeh Communist Party is spreading its wings. Tudeh is a longtime ally of the Soviet Union that has aligned itself with the Ayatollah's revolution from the start of the Islamic upheaval in 1978. Tudeh members are said to have infiltrated the Iranian bureaucracy, occupying positions of power in the security services and within the ruling Islamic Republican Party.

There is also evidence that the Tudeh Party has infiltrated opposition groups such as the leftist (but non-Communist) Mujahedeen Khalq. According to U.S. officials, safe houses of the Mujahedeens and other antigovernment groups have been disclosed to the ruling regime by Tudeh Party members.

The Russian involvement enhances the possibility of a long war—a possibility that many observers believe is rapidly becoming a probability. "There is little political incentive for a settlement on either side, and there is no serious mediation effort under way," says William B. Quandt, program director for energy and national security at the Brookings Institution. He adds: "For the next year or two, the prospect is that the war will continue."

Certainly, it doesn't appear that the two countries are being deterred by the war's enormous costs. By the warring powers' own accounts, the dead exceed 15,000 in Iraq, a nation of 14 million, and well over twice that in Iran, whose population is 40 million. The wounded run into several tens of thousands on both sides, and each country holds some 10,000 prisoners of war.

According to Arab bankers in London, Paris and Washington, Iran and Iraq have each incurred losses of $40 billion in damaged facilities alone. Iran's foreign-currency reserves, which totaled $12 billion in 1979, are down to less than $600 million; Iraq, which began the war with $35 billion in reserves, is estimated to be down to $16 billion. (That latter figure, however, doesn't include last year's $20 billion in aid from Arab countries.)

As recently as last month, when the latest of a half-dozen mediation attempts collapsed, both Teheran and Baghdad vowed to continue fighting until the opponent of each is vanquished completely. On Jan. 16, Iran's prime minister, Mir-Hossein Mousavi, warned: "Those states which provide support for Iraq will face disastrous consequences."

The Arabs know the Iranian threats aren't empty. Since the war began, Iran had sent its warplanes into Kuwait three times. (The last assault, in October, set an oil-gathering station ablaze.) But the Arabs are more concerned about the Iranian-inspired disturbances among their own citizens, particularly the Shiite Moslems who abound throughout the Gulf region. The Shiites, who rule in Iran, are a majority in Bahrain and constitute substantial minorities in Kuwait, the UAE, Qatar and the vital eastern province of Saudi Arabia that contains most of Saudi oil reserves.

"An Iranian victory would bolster Islamic revolutionary zeal throughout the region by making it appear that God is with Khomeini," a U.S. official says.

In the past few weeks, almost all observers agree, Iran has mounted a successful counteroffensive that has pushed Iraqi troops out of several areas inside Iran and that has brought Iranian troops closer to Iraq's own borders. A new Iranian offensive is expected next month.

"I believe the war is entering a very crucial stage in which oil facilities throughout the region may become seriously endangered," says James Akins, former U.S. ambassador to Saudi Arabia and a frequent traveler to Iraq and the Persian Gulf's Arab countries.

Whatever does happen, the U.S., to its consternation, will be a bystander—while the Soviets continue to expand their influence in the area. These days, the pervasive concern in Washington isn't that the Russians have signed up Iran as a satellite, but that the U.S. and other Western countries can't compete because they are absent from the scene.

"The Soviets have assets we don't have," explains a Reagan administration official. "They have an open border, a devoted party inside Iran and natives who share the culture and language of ethnic groups in Iran—and we aren't even in the ball game."

Senator JACKSON. It is an excellent article, and I recommend it to my colleagues.

The CHAIRMAN. I thank the Senator for raising this issue today as he did in his floor statement, and has repeatedly, because I don't think we can emphasize too strongly the fragility of that situation and the danger to us because of it. I commend the Senator from Washington for having done what he has done in speaking out on it and for raising the issue again today.

Senator JACKSON. I thank the chairman of the full committee because he, too, has from the very beginning been most active and cooperative in the effort. It was a unanimous decision, that of the committee, when we went ahead with the original SPR, and the previous administration wouldn't listen to the extent they should have been listening in terms of committing the necessary money.

I might point out that on the first 93 million barrels, as the chairman recalled, we made I think net as a result of it, what was it, $2 to $3 billion. The average price was $13 a barrel. At one point the acquisition cost hit about $41 a barrel.

The point I want to emphasize as strongly as I can is that the situation in the Middle East is more precarious now than ever. All one has to do is to look and see what is going on in Afghanistan, and I follow those matters fairly closely as a member of the Intelligence Committee, and I can only observe that we could be in a very difficult bind if we have a cutoff. I can just see our current economic recovery effort going out the window. The psychological impact of an oil cutoff and an inability to properly cope with it would be a disaster.

One of the major problems that we are still suffering in this country and in the Western Industrialized World is the fact that the price of oil went from a little over $3 a barrel to as high as $41 per barrel landed cost. I met with some members of the Japanese Diet yesterday that are here visiting in Washington. I urged that their government during this so-called glut to take advantage of the price opportunities to build up their reserves, and that should be done by all of the western industrialized countries, and I think the United States in particular should play that role. If we want to see a breakup of OPEC, it is going to occur when they see that the United States has an ability to take care of itself for at least 1 year in the event of a cutoff so that we can work out other arrangements, but if we are going to be once again the crippled giant, I think it will be a tragedy.

Now I would also like to mention, Mr. Chairman, the importance of the standby contingency plan that this committee approved and which is on the President's desk, and I hope he will sign it.

The CHAIRMAN. As do I.

Senator JACKSON. I know, and there are only a handful of votes in the Senate against it. Now if nothing else, it provides the right signal that we mean business and you cannot have an international energy program that we are now committed to with our Western industrialized countries if we don't have a contingency plan.

Now, Mr. Vaughan, there appeared in the Congressional Record, that is how I have it, the following paragraph taken from a memorandum that I gather you had written to the President in connection with this legislation. I read from it:

In light of the numerous stand-by energy supply contingency planning measures we have already initiated, this legislation is clearly unnecessary. Our aggressive, expanded Strategic Petroleum Reserve fill actions and private, industrial oil stockpiling initiatives will result in effective oil supply disruption mitigating measures. Expanded production of the Naval Petroleum Reserve is another policy which could be considered if circumstances became especially adverse. Stand-by emergency authorities are also available in the Defense Production Act and the Trade Expansion Act to permit us to re-examine the validity of the limited controls if reassessment is required by truly extreme circumstances. Thus we have a well-conceived and effective Government response plan in existence without the stand-by allocation authorities in S. 1503.

Mr. Vaughan, could you describe some of the numerous standby energy supply contingency planning measures already initiated?

Mr. VAUGHAN. Yes, sir. In the quote you listed the provisions involving the Department of Defense and the Defense Production Act.

We are currently trying to revitalize the electric power standby reserve, the oil and gas reserve, and the solid fuels reserve.

Senator JACKSON. I know what the statute says. You see, my question is simple. Could you describe the plans, the numerous standby energy supply contingency planning measures already initiated and give the committee copies of those plans?

I know what the statute says. The Defense Production Act has been in effect since the Korean war, 1950. We reviewed all those matters when we had this matter up, but what I am looking for is the implementation that you said is in existence.

Do you have standby plans that you could supply us with and describe it now and give us copies?

Mr. VAUGHAN. What we have, Senator, is first a revitalization of the standby reserves I mentioned. We believe that they will supply the Department and the Government with expertise to deal with a crisis rather than relying on Government officials alone.

We have the strategic petroleum reserve further filled, in fact, doubled from when this administration came in office.

Senator JACKSON. I think they have done very well on that. I have so stated, but I am still trying to get the plans here that you have initiated and if we have a cutoff tomorrow, that can be implemented immediately.

Mr. VAUGHAN. We have removed, Senator, the demand restraint programs that were in effect by our predecessors which will then allow prices to rise naturally, and then have a demand restraint program that is market oriented rather than Government allocation or decree oriented.

Senator JACKSON. The cutoff occurs tomorrow, Mr. Vaughan. Tell us what you do tomorrow and where are those plans and what does the Governor do or whoever? What happens?

Mr. VAUGHAN. If the cutoff occurs tomorrow, Senator, the first thing we would do is use the intelligence system that we have currently put in effect and use continuing analysis of the situation to provide the President with a day-to-day estimate of the seriousness of the problem.

Senator JACKSON. The Wall Street Journal has got that well documented, and I put that in the record. They make it very clear, and I must say it is good reporting on the part of Karen Elliot Hause. She is a very good writer on the Middle East. She is one of the brightest, sharpest, and I follow this over in the Intelligence Committee quite closely. She has got pretty good sources. I don't know where she got them.

Mr. VAUGHAN. And so do we, sir, and we can provide the boss, or the President——

Senator JACKSON. That is available now.

Mr. VAUGHAN. We would focus on oil matters, Senator, and so that we can advise the President as to the seriousness of that situation, the nature of the threat, our estimate of how long and deep it will be. We would provide a series of options as to what he might do, such as whether he should invoke the Defense Production Act, et cetera, whether he should use the strategic petroleum reserve and provide the full range of alternatives.

Senator JACKSON. But Mr. Vaughan, the act has been on the books since 1950. When you go to the President, you have to have a plan that you are going to say to the President "Sign this Executive order pursuant to the provisions of the Defense Production Act." Where is the plan that you mention in this memorandum recommending that the work of this committee be vetoed?

Mr. VAUGHAN. Senator, in specific on the Defense Production Act, I do not believe we or anybody else could draft in advance a specific order for the President to sign for a situation that occurs some time in the future.

Senator JACKSON. There is no plan then?

Mr. VAUGHAN. There is not that kind of plan.

Senator JACKSON. What kind of a plan is there in writing? That is what the committee needs to have, a standby plan. You don't wait until the disaster occurs. You have got a series of contingency plans. That is what national security planning is all about.

My little experience, I don't know much about it, but I have heard—you need a lot of contingency planning. Where is your contingency plan? You have asked that the President veto this bill based on plans that are already in existence that will be adequate. Now where are the contingency plans?

Mr. VAUGHAN. We are, sir, developing contingency plans.

Senator JACKSON. You are developing them?

Mr. VAUGHAN. In the process, and we do not apparently put as great store as some people do in a detailed, specific plan drafted in advance. In fact, we think that is counterproductive.

Senator JACKSON. So you don't have——

Mr. VAUGHAN. We do not have a detailed, line-by-line plan.

Senator JACKSON. This memorandum is kind of misleading, isn't it, to the President?

Mr. VAUGHAN. I don't think so, sir.

Senator JACKSON. Well, you talk about numerous standby energy supply contingency planning measures, contingency planning measures. Obviously a good planner is going to have a series of options that he can present to the President. If you think you don't do those in advance, I don't know where you got your training in the national security field because that is exactly what we do in the national security business. We have a series of them. What are you going to use, plan A or plan B is always subject to what that development is, but if you don't have those plans worked up, you are going to be in a big mumbo-jumbo, and the President is going to ask what have you guys been doing over there all that time? You are in charge.

Mr. VAUGHAN. I have been trying to describe to you, sir, the list of options that we would present to the President, and our recommendation, and we plan to do that on a daily basis if the situation requires.

Senator WARNER. Chairman McClure?

The CHAIRMAN. Thank you very much, Mr. Chairman. I am as concerned as the Senator from Washington is about how we would respond, and as deeply in disagreement with the recommendation for veto as is the chairman, as is the gentleman from Washington, former chairman of this committee.

I don't think that the administration has looked carefully enough at either the provisions of 1503 or what would happen in the event of a severe supply interruption.

There has been a tendency to look back at what happened under EPAA and say "Oh, my God, what a mess, we won't do that again." There has been no real attempt to distinguish between the provisions of EPAA and S. 1503. I don't care to debate that with you here this morning. The President will make the decision before the end of this week. I hope that his decision will not correspond to the memorandums that you have given him and the recommendation which you have given him, but I want to ask a couple of questions with respect to the SPR policy.

I share the determination that other members of this committee and of the Congress have, that we have a strategic petroleum reserve to draw upon in the event that it is needed. I share the conviction of most Members of the Senate that the strategic reserve should not be called upon until the last possible moment, under most circumstances, that we should draw down on inventories in the commercial sector first.

I assume that you agree with that position?

Mr. VAUGHAN. Yes, sir.

The CHAIRMAN. We have seen the advantage of larger, private sector inventories that were utilized when the Iran/Iraq war broke out. Even though there was high threat and there was price change, we got through that period without having to invoke further Government interference because we had inventories that did manage to meet our needs through that period of time, and we would expect that that is going to continue. We are trying to take some steps to increase the incentives for private inventories buildup, but in the meantime we have a very strong emphasis upon SPR, as this administration does, and as the Senator from Washington has noted, we made much more progress in the last year than we did under the previous administrations, but I note, too, that although Congress has mandated a 750-million-barrel reserve, and that there is talk for a billion-barrel reserve, that the facilities that we have available to us at the present time, or that will be available between now and the end of the program, are inadequate to maintain a level fill rate.

We cannot even do it just on an average per-day basis between now and 1989. We will run out of capacity before the end of 1983 if we fill at the rate of 300,000 barrels a day. Is that not correct?

Mr. VAUGHAN. If we filled at the rate of 300,000 a day, Senator, we would definitely exceed capacity.

The CHAIRMAN. Isn't there an advantage to filling at 300,000 barrels a day, when there is softness in the world oil supply demand ratio, and it is a buyer's market today compared to last year and perhaps to next year?

Mr. VAUGHAN. Yes, sir. There are many who think that there is real advantage to buying it under these circumstances, and we are very seriously looking at that. We have to balance, however, that against very serious budgetary considerations, and that is a tough decision.

The CHAIRMAN. It is a budgetary decision alone that leads us to provide it at a lower rate?

Mr. VAUGHAN. I think it is fair to say that it is, Senator, in this sense, that the current capacity limitations are really the result of the budget decisions made 3, 2, and 1 year ago and weren't foreseen. Actually these capacity figures are nothing new. They have been projected for some time.

The only thing that this administration has done with respect to capacity is very specifically with respect to phase III, Big Hill, that one part of phase III has had some of its out-year funding deferred so that it will cause it to be 1 year later coming online than the previous plan; 1989 slips to 1990 for arriving at 750 million barrels.

The CHAIRMAN. That is a change from the past plan. I am aware of that. However, if we were to accelerate construction we would not run into the storage constraints that will apply not just to Big Hill but to the balance of the storage system; is that not correct?

Mr. VAUGHAN. Senator, if we wish to accelerate the fill, we would have to come back to the Congress for additional funding for facilities since that is a different account than the oil purchase account, and we would have to go to some sort of interim storage or another technique of storage than salt caverns.

The CHAIRMAN. You have not made that request, have you?

Mr. VAUGHAN. We have not made it. We are seriously looking at that at this time.

The CHAIRMAN. Do you know what it would cost you to include in the 1983 budget facilities, moneys that would be necessary to continue that fill rate? What would we have to add to the 1983 budget if we were to make the decision that we want to provide the facilities, and I am not talking about the lease option. I am talking about the construction program.

Mr. VAUGHAN. For construction, Senator, it seems to me that if we were talking about constructing permanent facilities, about the only option that would be open to us, that would accelerate, would be steel tanks, aboveground tanks, if we are creating a permanent facility.

Our outlook is that we would be better off if we desired to accelerate the fill to go to interim storage and stick with the basic salt storage since we think that is the best expenditure of the taxpayer's money over time.

The CHAIRMAN. There is one further change that ought to be reflected, and that is under the Strategic Petroleum Reserve Amendments Act of 1981, and I would refer you to 42 U.S.C. 6231 note, in which the 300,000 barrels per day was established by congressional enactment, that wasn't done in a vacuum. That was done with administration support and consultation and agreement, so if we drop below the 300,000 barrels per day, there is a change in policy other than the Big Hill facility. We have not done what was intended to be done as written by Congress and as agreed to by the administration.

I am a little concerned that we are trying to suggest that the stretchout of the fill rate is not a change of policy when as a matter of fact it appears to me that it is.

Mr. VAUGHAN. Let me try to be very clear about that, Senator, as to what this specific administration's involvement with that is.

The stretchout of 1 year of the Big Hill facilities from 1989 to 1990 is a decision of this administration, and a policy change, and I have tried to clearly indicate it as such.

I tried to also point out, sir, that the capacity constraint we currently have is the result of budget decisions 2, 3, and a year ago.

The CHAIRMAN. But in spite of that budget constraint of 3, 2, and 1 year ago, we wrote into the statute that we are going to achieve an average fill rate of 300,000 barrels a day, and you are not seeking the money that is necessary to do that.

Now that is a policy change, and I want to know why, and you are asking in addition to that to defer money which we have already given. That is a policy change. I want to know why.

Mr. VAUGHAN. Senator, this administration's policy has been to fill the reserve to capacity, and the only change in policy has been the deferral this year. We picked up the program when we came on board and attempted to fill that capacity which was lying there vacant in effect.

The CHAIRMAN. But this administration agreed to the average annual fill rate of 300,000 barrels a day. That language was negotiated with this administration. There were three Cabinet officers and the President involved in that decision.

Mr. VAUGHAN. I can't answer that particular question, Senator. I am certainly not disagreeing with you. We certainly, as I understood the language, were to seek that level, and as I say, we are certainly looking at the subject of interim storage which would boost our ability to acquire oil.

The CHAIRMAN. Let me read you the language, and I don't mean to belabor this, Mr. Chairman, but I think it should be laid upon the record.

The language of section 1033 of the bill, section 16(c) of the Energy Policy and Conservation Act is amended to read as follows, and I quote, (c)(1), "The President shall immediately seek to undertake and thereafter continue subject to paragraph 2 crude oil acquisition, transportation, and injection activities at a level sufficient to assure that crude oil storage in the strategic petroleum reserve will be increased at an average annual rate of at least 300,000 barrels per day."

Senator BRADLEY. That was the language in response to my amendment on the floor; is that correct?

The CHAIRMAN. That, incidentally, was signed by the President in August of last year, and the President was involved in those negotiations as were three of his Cabinet officers. It seems to me that that is relatively clear and straightforward language.

If we are not now going to do that, then there is a change of policy and all I am trying to get at is why the change in policy? If it is purely budgetary, we simply can't afford it; if we have decided we would rather do that than cut social security benefit increases, whatever it may be, somebody has made a decision somewhere I assume, and it would appear to me if there has been a change of policy, it ought to be a rational one founded on some logical basis which the administration is willing to support and present to us as a change of policy and say here we have changed our mind about what we agreed to last year. We want to change the program in these respects for these reasons, and ask the Congress to approve that change in policy.

Now I also sit as chairman of the Interior Subcommittee of the Appropriations Committee, providing them facilities money, and I am going to have to sit in another forum trying to determine whether or not we ought to give you the money you haven't asked for to do what the administration last year agreed to do, so it isn't just a question of abstract principle. It is also a question of we will have some reflection in the budgetary process as we determine what kind of money to give to the administration for the support of various programs, and there is another alternative to the facilities money which we need to determine, and that is the possibility of leasing storage. We could go either way, but so far I haven't even been able to find out why we have changed if indeed we have changed away from the 300,000-barrels-a-day fill rate.

Mr. VAUGHAN. Senator, I think we are trying to find ways to meet that rate, and I mention that we are certainly looking very seriously at interim storage and certainly included in interim storage is the ability to lease how we could fund that and what additional cost that would be to the program to use that technique because we are certainly at this stage as we came on board locked into capacity restraints in the short term for permanent storage.

The CHAIRMAN. But we also locked into an agreement last year a 300,000-barrel-a-day fill rate which you by your actions are denying and saying that it is a capacity constraint. If as a matter of fact we are to exercise any choice between the construction of capacity or leasing of capacity, we are going to be faced later on with no choice at all. We will simply have to lease available capacity because we will have abandoned our goals—one or the other. We will have forgone the other option of constructing our own capacity. Is that correct, simply because of the lapse of time?

Mr. VAUGHAN. The only change in construction of capacity, Senator, is the deferral of Big Hill for 1 year. That is the only change in the rate of construction of capacity.

The CHAIRMAN. Yes, but you agreed last year, the administration did—I am not saying you personally—to a fill rate of 300,000 barrels a day. That has certain implications for us. We had the budgetary fight over whether that SPR money was going to be on-budget or off-budget. It was eventually compromised in the Congress that we would put the SPR money off-budget so that the acquisition moneys were thus insulated from the ordinary balancing of the budget equation. Rightfully or wrongly, that was done and acceded to by the administration.

The construction money, the facility money, was left on-budget. Once the administration agreed to a fill rate of 300,000 barrels a day, there certainly was a nearly explicit understanding, certainly a policy choice, that would say that they would have to have the money to provide the facilities.

We haven't seen that request for facilities. Instead we have seen a request for deferral, and that flies in the face of the fill rate agreement, and it seems to me that as you look at this, I have to conclude that the administration has either totally ignored or totally forgotten or changed its mind about the commitment to the fill rate, and all I am trying to find out is what is the administration's position?

Did you look at the fill rate and decide you don't want to do it, or did you just ignore it or is it just kind of floating off there some time in 1982 or 1983 when we will find out we couldn't do it and then we will end up with only one of two alternatives, abandon the fill rate, or lease additional facilities? And the leased facilities according to Secretary Edwards will cost us $150 to $200 million a year in annualized cost for lease capacity. GAO has made its report. We have one of last fall. We have another one of March 12 in which they outline the various costs of the alternatives.

It seems to me we need to focus on that, to come to some kind of a rational discussion and decision concerning the policy objectives and alternatives that confront us.

Senator WALLOP. If you would yield just for an insertion in this, too, the one thing that cannot exist now which existed a year ago was the foreign policy considerations of defending any of OPEC for trying to put oil in the strategic reserve in a period of shortfall. They were suggesting they were going to pinch back. Now we have the glut. That can't be a consideration any longer either, so I think the chairman's question is well put.

Senator WARNER. We will now turn to Senator Matsunaga.

Senator MATSUNAGA. Thank you, Mr. Chairman. Mr. Secretary, my State of Hawaii is some 2,500 miles from the continental United States, and is, as you know, without any indigenous fossil fuels. Hawaii today is importing as much crude oil as the period just before the 1973 energy crisis, and mostly from OPEC sources.

As you know, Hawaii is a vital military air and sea fueling link for our Armed Forces in the Pacific basin. Unfortunately, it is as far away from the salt domes of Texas and Louisiana, where the central storage reserves are located as Istanbul is from New York or South Carolina. Any oil from this central reserve must be shipped in tankers that must pass through the Panama Canal.

The notion that Alaskan or Californian crude can solve this problem is, of course, without foundation, for there will be difficulties with product balance and exchange agreements that have yet to be addressed.

I am aware of the budgetary difficulties faced by our Nation, but I am deeply concerned that Hawaii and our Pacific basin defense system are not adequately protected from an oil supply disruption. Something needs to be done, and the time to do it, I believe, is now, when oil prices are soft and supply abundant. So I would like to suggest, Mr. Secretary, that you look into working out an arrangement with the Department of Defense, the State of Hawaii, and the appropriate private sector interests, to take care of this precarious situation.

One suggestion that can be explored is to use existing storage tanks. As you know, your office last month announced a request for procurement for temporary storage of crude oil. With a very slight modification for interim product storage, you can use tank space that is already available in Hawaii. This tank space, both civilian and military, represents a capacity of about 23 million barrels, a good percentage of which is not presently being used.

In this connection, I am informed that the largest refiner in Hawaii never did receive your original RFP, request for procurement, and only recently learned that such a program existed. So my question to you is, Mr. Secretary, why not consider long-term leasing of product storage from private industry in Hawaii as an interim measure until the problems of the emergency crude oil availability for Hawaii and the Pacific basin can be resolved?

Mr. VAUGHAN. Senator, as I answered in response to one or several of your colleagues, we are looking at the subject of long-term and for that matter short-term leasing as a way to allow us to increase the fill rate of the SPR.

If I understood your question, though, sir, I thought you directed your comment toward product rather than crude oil. Heretofore the strategic petroleum reserve has made a conscious program decision not to be involved in product for a number of I think fairly good reasons. Specifically crude oil can be stored for a relatively indefinite period. Product cannot. They have a fairly high turnover rate. It would keep the Government in the oil business and make it an active participant in the oil business, and it is not our desire to do that. It certainly hasn't been heretofore.

We are working with the Department of Defense. The DOD people are interested in product much more than they are crude oil because, of course, the weaponry, fighting vehicles and so forth, use product, not crude. Their focus is on product rather than crude.

Senator MATSUNAGA. Even for crude where we do have, as I pointed out, tanks which are available for storage, couldn't you enter into a temporary arrangement or interim measure for leasing the storage space?

Mr. VAUGHAN. It is not at all clear to me, Senator. I would certainly be glad to look into this problem, why the refiners in Hawaii are not storing crude if they have the capacity as you have indicated. Apparently they do.

Senator MATSUNAGA. Of course, for business reasons I suppose, but do I understand you, Mr. Secretary, to say that you would be willing to assume the initiative of getting together with the Department of Defense, the State of Hawaii, and the private sector to determine whether some arrangement of this sort can be made in Hawaii to meet not only Hawaii's problems but the problems of the military which are so necessary to be resolved in case of an emergency as was proven in World War II?

Mr. VAUGHAN. We will again open this subject, Senator, and take an objective look. I cannot promise you what the results will be. I will tell you that subject was not overlooked in the past. It was merely decided that the money was better spent with the reserve back here in the continental United States, closer to our refining capacity, but we will look again at the problem.

Senator MATSUNAGA. Could I take this as a commitment that you will as soon as possible arrange for a meeting of these parties?

Mr. VAUGHAN. Yes, sir.

Senator MATSUNAGA. Thank you very much. I appreciate it.

Senator WARNER. Senator Bradley?

Senator BRADLEY. Thank you, Mr. Chairman. Mr. Vaughan, first let me say that I think that you very clearly understand the issues of emergency preparedness, and I frankly wish that your voice had prevailed more frequently within the administration than it has, and I am curious as to what your assessment is of what the President's action will be on S. 1503.

I know you recommended that he veto that piece of legislation. I am curious what you think the reaction will be.

Mr. VAUGHAN. Senator, let me try to answer that, your question, in this manner. Obviously something like a veto is one of the supreme political acts a President can take, and I really am not in a position to tell you with any certainty what the President will do when he balances those considerations.

I can only tell you that I and my Department have strongly urged him along with other departments and portions of the administration to veto this legislation, and I must tell you that I am very hopeful that he will do that, but I cannot tell you what he will do.

Senator BRADLEY. The argument has been made I think today in committee even that the President couldn't possibly veto the legislation because there is no alternative.

Do you agree with that, Mr. Vaughan?

Mr. VAUGHAN. No, sir, I do not.

Senator BRADLEY. What would be an alternative as you see it?

Mr. VAUGHAN. I believe he should veto that legislation, and then that act in itself would send the correct signals to the energy marketplaces of this country that the Government will not again intrude with price and allocation controls, and would also send a very strong signal to those interested in storing oil and product or crude that again Uncle Sam wouldn't come in and deny them the fruits of their preparedness.

I think that the most constructive thing this or any other administration can do for the subject of private storage is to remove the signal that the Government will take it away from you and give it to someone else.

Senator BRADLEY. Would you personally favor some form of recycling program such as the one that I proposed last year during debate on this issue?

Mr. VAUGHAN. Senator, I am familiar with your proposal, and I think, personally think, it makes a lot of sense. I do have a lot of other people in the administration to try to persuade to that viewpoint, and I have heretofore been unsuccessful.

Senator BRADLEY. Mr. Vaughan, that is one of the reasons I complimented you at the beginning on the outstanding job you did.

In your Department of Energy request you requested for the strategic petroleum reserve $4,939 million; is that correct? The Assistant Secretary it says requests for budget authority for fiscal year 1983 $4,939 million.

Mr. VAUGHAN. Let me check that, Senator. It doesn't sound right to us.

Senator BRADLEY. I am informed by staff that these are known to those people in the inner sanctum as the Holifield tables.

Mr. VAUGHAN. I am told, Senator, that that was a number that preceded my coming into office and was in the early planning process, and I frankly was unaware of the Holifield table.

Senator BRADLEY. OK. Well, the table reveals that the Assistant Secretary for the strategic petroleum reserve requested $4,939 million. The Secretary requested of OMB $1,400 million, and we have requested in this budget, at least the President has, $2,316 million.

My question to you is, How would you spend $4,900 million on the SPR in fiscal year 1983?

Mr. VAUGHAN. Let me ask Mr. Furiga to try to answer that since he was present when these numbers were processed.

Mr. FURIGA. Senator, when that number was derived, a large part, of course, was to buy oil, and the oil prices used in that early budget were quite high, and that is why that the oil budget we have submitted for 1983 looks lower than what people might think it should be compared to 1982.

The $1.6 billion reduction is purely because of a lower oil price assumption used in the present stage of the budget.

Senator BRADLEY. Aren't you prepared for a fill rate of 208,000 barrels a day in 1983, and as the chairman very clearly read to you, you are supposed to be preparing in the administration—I learned something today. I didn't know it was negotiated with three Cabinet officers and the President, that you are supposed to be filling at 300,000 barrels a day?

Mr. FURIGA. Our budget has shown for the last 2 or 3 years that that average of almost 200,000 barrels a day, 209 in 1983, and the oil money that we have asked for, $2 billion will allow us to have about 46 million barrels on order at the end of fiscal year 1983 for delivery in fiscal year 1984.

Senator BRADLEY. That reduced request from the administration would not allow for 300,000 barrels a day fill?

Mr. FURIGA. No, sir.

Senator BRADLEY. But would only allow for roughly 200,000 barrels a day fill, contrary to what we learned this morning and what the chairman read from the report of last August?

Mr. FURIGA. Yes, sir; the budget submitted was for a 209,000 barrels a day for fiscal year 1983.

Senator BRADLEY. You have a 100,000 barrel shortfall. Now let me ask you, as I understand it, this 1983 request, 87 percent of the money for the purchase of oil in fiscal 1983 is the purchase of oil for delivery the following fiscal year, is that correct?

Mr. FURIGA. Yes, sir.

Senator BRADLEY. And these are contract purchases; is that correct?

Mr. FURIGA. Yes, sir.

Senator BRADLEY. The average spot price according to Platt's most recent publication is roughly $5 less than what the SPR has contracted for, so if you are locked into the purchase of oil in the

1983 budget for delivery in 1984, and you have used up your 1982 dollars, you are not able to take advantage of a $5 saving on a barrel of oil.

You argue that the price of oil has dropped. That is correct, but unless you can respond to a spot market in which the price has dropped, you can't take advantage of that drop in price because you are locked into a contract price that is much higher for delivery in 1984, so what would prevent you from taking advantage of the lower spot market prices? What is the limitation?

Mr. FURIGA. If we are talking about the oil that we had planned to advance purchase at the end of 1982 for delivery in 1983 and the oil we had intended to advance purchase in 1983 for delivery in 1984, there is nothing locking us into having that under a term contract. There is nothing that says we can't buy that oil on the spot market. We don't have the permanent facilities to put the oil in.

Senator BRADLEY. OK. You are saying there is nothing in the law that would prevent you from taking money that is for 1984 and buying a lot of spot market oil in 1983, right?

Mr. FURIGA. I believe that is correct.

Senator BRADLEY. Except you have capacity limitations.

Mr. FURIGA. That's right, sir, and our fill is based on that capacity.

Senator BRADLEY. Can you justify on any national security ground, or even budgetary ground, the point the chairman was making which is why don't you have some kind of interim capacity to take advantage of this bargain sale in the spot market where you could buy, if you were mandated, you are supposed to fill at 300,000 barrels a day, you get it for $5 less a barrel, that is a million and a half dollars less you would have to pay for oil per day if you had some place to put it.

Now, how serious are you about finding some place to put it and when will that occur?

Mr. VAUGHAN. I think, Senator, that the mere fact that we recently sent out a proposal asking for a response from the industry, solicitation or proposal, indicates that we are seriously looking at acquiring storage on some kind of lease or temporary basis.

Senator BRADLEY. Where is the money going to come from for that lease?

Mr. VAUGHAN. If we go to temporary storage, it is my understanding of the statutes that we will have to come back to the Congress for additional funding.

Senator BRADLEY. I see.

Mr. VAUGHAN. That we can't use oil money for facilities.

Senator BRADLEY. You have said assessing probability. What is the probability you are going to come back and ask for more, and the other question is if you haven't asked for it in the first place, what is the probability you will even have a chance of getting it? You don't have to answer the last question.

Mr. VAUGHAN. We are driven, Senator, by the twin goal of certainly we are mindful of national security implications, and we are also driven by the goal of getting the best for the taxpayer, for his dollar, so as these prices drop, it is one of the prime reasons we are so interested now in looking at the ability to increase our capacity to have oil.

What we will have to do is trade off the rental we will pay in temporary facilities against the additional oil and try to make a judgment that that is a wise business-like decision.

Senator **Bradley**. Instead of having you have to come back to the Congress after you have say sent out your notices to all of those people that might have storage, and you get back the responses, and they say yes, we would be willing to lease it to you, *x* dollars, then you have to come back to Congress and say now we want *x* dollars to lease storage for oil, what if we just gave you the flexibility to take some of the dollars for oil purchase and use it for interim storage?

Mr. **Vaughan**. That is workable, Senator.

Senator **Bradley**. So that is a possibility that we might consider?

Mr. **Vaughan**. Yes, sir.

Senator **Bradley**. Is that correct?

Mr. **Vaughan**. Yes, sir.

Senator **Bradley**. All right. Now let me ask you one other question on drawdown strategy. You know, we are building reserves that are not being built fast enough, at a big enough fill rate. We have been over this territory. There is not enough interim storage, but assuming we can solve all those problems, the issue then is under what conditions do you draw the reserve down and how do you do it?

In your view, as you weigh the relative merits between allocation or auction of SPR, could you share with the committee your pros and cons on each of those routes and which one you would recommend the committee to discuss or settle on?

Mr. **Vaughan**. As I answered that, Senator, let me try to state the direction from my superiors through the Cabinet Council.

This summer in addressing this subject, the Cabinet Council directed that SPR drawdown be in the most market-like manner we could conceive of at the certain time we needed to consider drawdown, and I certainly agree with that kind of direction. Not only did this administration believe in markets and believes that they are the best allocators and so we will try to use the SPR as it supplements the market or augments it in a manner least disruptive of that market, there are those, and I certainly have to address the problem, that concern themselves about regional problems that may occur, and if those types of problems occur where the market will not by itself take care of it, we will have to address those at the time.

I will tell you, sir, we will do that very reluctantly, to interfere with the market process.

Senator **Bradley**. So what does that mean, allocation or auction?

Mr. **Vaughan**. It means that we will definitely try to auction that oil, and we strongly believe that that is the best way of distributing that oil.

Senator **Bradley**. I agree, Mr. Vaughan, for what it's worth.

Senator **Warner**. Mr. Bradley, we have got a number of witnesses.

Senator **Bradley**. One last question, Mr. Chairman; on the issue of your sending out bids for interim storage, is it correct that a number of those proposals will be submitted by companies on the eastern seaboard with aboveground steel tanks?

Mr. FURIGA. Senator, we issued an invitation for basic temporary storage ordering agreements, and I use the term "temporary" as opposed to interim storage. The temporary storage is our normal operational storage in case we have to divert a cargo, if one of our ports is closed. The temporary storage agreements usually provide 2 or 3 million barrels of storage usually in the gulf coast area or in the Caribbean.

Since that solicitation was going out in the street, last month I decided to put an option for a longer term basic ordering in it to see what was out there. Although there is no obligation to award contracts under that option, we can award basic ordering agreements.

Senator BRADLEY. Let's say there are some companies on the eastern seaboard that do have storage. Would the Department of Energy accept them on an interim or permanent basis?

Mr. FURIGA. We would have to evaluate the cost and just what type of tankage they were offering. I have met with those gentlemen. I understand most of the tankage they are offering is not crude tankage. It is product tankage which might require conversion to crude storage. They are smaller tanks than we are using, sir, but we would accept their offer to evaluate it and consider it.

Senator BRADLEY. How soon could you do—not the particular storage, but let's assume you get these offers back in, how soon—say we gave you flexibility. How soon could you take advantage of that flexibility, get contracts out, and get oil flowing into interim storage from the spot market?

Mr. FURIGA. I am going to try and bracket that, Senator. Once we had the offers back, assuming the range of anywhere from 25 to 50 offers, I think that is reasonable, I think we could have the interim storage contract awarded in 30 days—not all of them, but there would be a sequencing of awards.

The open continuous solicitation to buy crude that we used quite well last year has about a 2-week cycle. Most of the crude I believe right now is off the water. It is back at the producing country, so allow at least 30 to 45 days transit time. That is about what we are talking about.

Senator BRADLEY. Within 90 days you could actually——

Mr. FURIGA. After we receive the offers, there should be some crude coming in within 90 days; yes, sir.

Senator BRADLEY. Thank you very much. Thank you, Mr. Chairman.

Senator WARNER. We will now turn to a new panel. Dr. Charles Ebinger is director of Energy and National Security Issues, Georgetown Center for Strategic Studies.

Mr. Ebinger, we welcome you.

Dr. EBINGER. Mr. Chairman, I want to thank you for inviting me to testify before your committee on the subject of the strategic petroleum reserve. I would like to summarize my remarks but request that my entire testimony be written into the record.

Senator WARNER. That will be done.

STATEMENT OF DR. CHARLES K. EBINGER, DIRECTOR OF ENERGY AND NATIONAL SECURITY ISSUES, CENTER FOR STRATEGIC AND INTERNATIONAL STUDIES, GEORGETOWN UNIVERSITY

Dr. EBINGER. Before commencing my discussion of the strategic petroleum reserve, however, I would like to state categorically that I and my colleagues at the Georgetown Center do not share the current conventional wisdom that the energy crisis is over. Looking forward at the decade of the 1980's, we believe that on the basis of market factors alone, there is little reason for complacency that the energy crisis is behind us.

Some of the critical factors underlying our view are: First, the impact that falling oil prices will have in postponing high cost conservation and the development of expensive alternative energy technologies.

Second, during the decade of the 1980's we believe that the energy demand in the non-OPEC Third World nations and in the OPEC countries themselves will rise at an extremely fast rate, a rate which in our view will largely offset the positive developments leading to a decline in demand in the OECD nations.

Likewise during the decade of the 1980's, we believe there is a strong likelihood that the Soviet Union will move from a position of net exporters of almost 3 million barrels a day to a position where the East bloc becomes small net exporters, and in addition, contrary to popular conceptions, we believe there is now a very real possibility that in the short to medium term the People's Republic of China may also become a net importer of oil.

My colleagues and I are not convinced by the existing literature on how much of the apparent drop in oil consumption in the OECD nations during the last 2 years has occurred as a result of permanent structural conservation and how much has been the result of global industrial recession, short-term conservation measures, and fuel switching in some cases owing to the availability of lower-priced natural gas which might not have occurred if gas prices had been decontrolled. On this point, we do not wish to sound like Cassandra but merely hope to sound a note of caution for the committee that in our view, the econometric analysis done on this question to date is extremely inconclusive.

In addition to these broad market trends, we believe there is little reason to be sanguine that political upheavals in one or more of the major oil producing nations will not occur during this decade. As Senator Jackson noted earlier today, at this very moment the Iran/Iraq war seems to be intensifying and I need not elaborate on the impact that a spread of hostilities to Kuwait, the United Arab Emirates, or Saudi Arabia itself would have on global petroleum supplies.

Likewise, we see little reason to be optimistic about the current drift in Arab-Israeli relations and believe that if current trends continue, a crisis of immense proportions could soon be upon us in Lebanon. Such a crisis will have political ramifications throughout the Arab world and depending on the U.S. response to that crisis, could put the last nail in the coffin in effecting the administration's policy of building a strategic consensus in the Middle East both against the Soviet Union and as a way of insuring access to oil supplies.

Finally, we are deeply worried about the impact that falling oil prices may have on the political, economic, and social stability of many OPEC as well as non-OPEC oil-producing nations. With rising expectations of a large majority of the populace of these nations now at a fever pitch, the specter of massive shortfalls in petroleum revenue, and the attendant impact that this may have on the development programs, could cause profound dislocations in countries such as Nigeria, Indonesia, Mexico, and Algeria.

With many of these nations now likely to go into deficit, the poor nations of the Third World already in desperate need of new loans from international banks may find it increasingly difficult to obtain them, and the specter of real default by several nations will be exacerbated by these developments.

It is only against this larger backdrop of energy and security issues that we believe the subject of energy emergency planning, including SPR policy, can prudently occur. Despite two major and several smaller disruptions to oil supplies since 1973, to date energy contingency planning has not received adequate attention, and I'm sorry to say this has been particularly true in our view of our friends in the Reagan administration.

The decision to dismantle the Department of Energy has sent the wrong signal to almost everyone. Having just returned from Western Europe, I think it is important for this committee to understand that it is incomprehensible to European government and industry leaders how the Reagan administration can argue about that the Siberian gas pipeline is a vital alliance energy and security issue at the same time that the administration's proposed budget calls for drastic reductions in the fill rate of the SPR, a 40-percent reduction in the budget for emergency contingency planning, and a total elimination in fiscal year 1983 of the Office of International Energy Affairs in the Department of Energy which plays a vital function in U.S. participation in the International Energy Agency.

The Europeans are incredulous there is a possibility that if President Reagan vetos the Standby Petroleum Allocation Act, and with the antitrust exemption allowing U.S. companies to participate in the IEA, that U.S. participation in the IEA will cease, that our allies could even believe that Congress would not take remedial action to insure this does not occur strikes us as indicative of how far the current drift in U.S. alliance energy relations has become.

Likewise, they do not understand, nor must I admit do I, how we can reconcile spending billions of dollars to defend the oil fields of the Middle East, yet refuse to enact more effective and far less costly measures here at home that will protect us against an energy emergency.

Before turning directly to the SPR, let me note that the SPR should be viewed as only one element, albeit a critical one, in implementing a much broader energy contingency program.

In our recent emergency energy report, we at the center advocate in addition a major strengthening of the Office of Energy Contingency Planning in DOE under Mr. Vaughan to include responsibility for all energy emergency planning, both domestic and international, including management and operation of the SPR.

The Assistant Secretary for Emergency Planning would be responsible for integrating the FEMA's crisis management effort, developing an improved information gathering and dissemination system, and chairing an interdepartmental task force drawn from other sectors of the Government critical to managing an oil crisis.

Second, we believe that the provision of financial and technical assistance to State and local energy offices should be restored to the Federal budget. Likewise, we believe that on an urgent basis a permanent private sector task force on energy and contingency planning should be formulated. We believe that there should be a strengthening, not a weakening, of the Federal Energy Information System. We believe support of the IEA effort to stiffen its demand restraint program and to set more stringent oil import ceilings should also be enacted.

We also support very strongly the enactment of joint IEA stock drawdown policies and feel that drawdown policies for the SPR should be incorporated into a broader IEA-wide system, and finally, we believe that the U.S. State Department should work actively to encourage Mexico to develop an emergency production capacity for oil and natural gas in return for substantial trade concessions and enactment of a comprehensive guest worker program.

As part of our comprehensive energy emergency plan, I believe the U.S. Government should move to purchase oil for the SPR at the 300,000 barrels a day target rate sought by Congress in the Omnibus Budget Reconciliation Act of 1981. Under the reduced fill rate proposed by the Reagan administration, we will not reach the goal set by President Carter of 500 million barrels by 1980 until 1986 at the earliest. With oil import levels in our view likely to remain above 5 million barrels a day throughout this decade, and given the market and political uncertainties I outlined at the beginning of my testimony, I believe we must move quickly while oil prices are under pressure to insure our security.

As my colleague Mr. Kessler and I argued in congressional testimony last July before the Sharp committee, the SPR must be viewed as part of our larger national defense program. This view has recently been reaffirmed by the 1981 report of the National Petroleum Council on Emergency Preparedness and by the House/Senate conference report on the Stand-by Petroleum Allocation Act of 1982. Our own 2-year report argues that by all reasonable probability, the oil fields of the Persian Gulf cannot be protected by the RDF, and that measures taken here at home are far more likely to provide us energy security. Only when the SPR is large enough that it can protect our security while at the same time providing us with a mechanism to meet our obligations under the IEA emergency oil sharing mechanism will the SPR be an effective energy emergency vehicle.

While we sympathize with the administration's budgetary concerns and understand its desire to postpone expenditures, we dissent with the view that other short-term storage options are not available. Currently there is over 60 million deadweight tons of VLCC surplus capacity. Even with personnel costs, bunker fuel requirements, et cetera, this storage capacity could in our view be leased by the U.S. Government at costs of roughly $3 to $4.25 a barrel, not significantly different than the development of new underground storage, roughly $3.33 a barrel, and far below aboveground storage costs of $9 to $10 a barrel in 1981 dollars.

In addition, other short-term storage facilities could comprise the 30 million barrels of privately owned underground storage capacity along the U.S. gulf coast. In addition, the American Petroleum Institute estimates that between 3 to 4 million barrels a day of crude oil and an undetermined amount of product storage may exist currently at U.S. refineries. Moreover, given current slack market conditions, various energy marketing companies and other end users may have additional storage sites available, and we urge quite strongly that the Government look into this availability.

In short, it appears in our view that conceivably some 50 to 100 million barrels of additional capacity may already exist and be available to the U.S. Government.

In addition, while precise figures are difficult to obtain, there is tremendous potential underutilized storage capacity in both the Caribbean on a number of different islands, including the island of Puerto Rico, and in the maritime provinces of Canada, and in this regard it should be remembered that when the SPR was first set up, there was legislative authority given both to creating regional petroleum reserves, and industrial petroleum reserves. The incorporation of the Caribbean into the SPR system could in our view prove a useful component of our new Caribbean Basin policy as well as our strategic petroleum reserve policy.

Similarly, the development of a regional SPR in Canada, while posing certain political problems in New England, could in our view aid New England in the event of another supply disruption.

If all these initiatives were pursued, the SPR could reach its target goal of 500 million barrels by late 1983 to early 1984. With the duration of the oil glut far from certain, and some OPEC countries under intense pressure to sell their oil, we believe now is the time to purchase oil for the SPR.

Therefore, we dissent from any policy of reducing oil purchases out of budgetary considerations.

Mr. Chairman, time does not allow me to go into great detail, but I would like to call to the committee's attention some serious problems that we believe must be addressed in implementing an effective strategic petroleum reserve policy. These are, first, what is the relationship between an activation of the IEA trigger mechanism, and the decision to utilize the SPR?

Second, does the administration's policy of relying on the market to allocate supplies during a crisis fulfill the demand restraint policies of the IEA agreement? What role should the SPR play in meeting supply shortfalls early in a crisis?

Third, should domestic or IEA obligations receive priority in any SPR drawdown strategy?

Fourth, how should SPR oil be placed, be priced when made available to consumers?

Fifth, should access to SPR oil be conditional on commercial concerns, having held a certain prudent level of stocks?

Sixth, how can we avoid having the SPR become a substitute for privately held commercial stocks should the SPR be incorporated into a broader IEA-wide stock and drawdown policy?

Finally, what role should Elk Hills and the National Petroleum Reserve in Alaska play in constructing a comprehensive strategic petroleum reserve policy for the Nation?

Those questions do not have easy answers, Mr. Chairman, but perhaps we could address some of those in the questions and answers.

That concludes my testimony, and I would be glad to take questions.

[The prepared statement of Dr. Ebinger follows:]

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PREPARED STATEMENT OF

Charles K. Ebinger

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Before the

Committee on Energy and Natural Resources of
the United States Senate

Hearings on The Strategic Petroleum Reserve

March 16, 1982

Mr. Chairman, I want to thank you for inviting me to testify before your Committee on the subject of the Strategic Petroleum Reserve. I would like to summarize my remarks but request that my entire testimony be written into the record.

Before commencing my discussion of the Strategic Petroleum Reserve, I would like to state categorically that I and my colleagues at CSIS do not share the current conventional wisdom that the energy crisis is over. Looking forward at the decade of the 1980's, we believe that on the basis of market factors alone there is little reason for complacency that the energy crisis is behind us. Some of the critical factors that underlie our view are:

(1) The impact that falling oil prices will have in postponing high cost conservation and the development of expensive alternative energy technologies. In this regard let me note that when the Energy Security Act of 1980 was passed just two years ago, it was believed that by 1992 we would have developed 2.2 mmbdoe of Synthetic fuels. Today various industry forecasts predict little more than 150-200 mbdoe by that time.

(2) During the decade of the 1980's, we belive that energy demand in the non-OPEC Third World nations and in the OPEC countries themselves will rise at an extremely fast rate. In our view, the growth in demand in these countries from just

under 8 mmbd in 1981 to 13-16 million in 1990 will go a long way in offsetting the decline in demand in the OECD nations.

(3) During the decade of the 1980's, we believe there is strong likelihood that the Soviet Union will move from a position of net exporters of 3 mmbd to a position whereby the East Bloc become small net exporters. In addition, contrary to popular conceptions,we believe that the People's Republic of China may in the short-to medium term become an importer of petroleum.

(4) My colleagues and I are not convinced by the existing literature on how much of the apparent drop in oil consumption in the OECD nations during the last two years has occurred as a result of permanent structural conservation and how much has been the result of global industrial recession, short-term conservation measures, and fuel switching in some cases owing to the availability of lower priced natural gas which might not have occurred if gas prices had been decontrolled. On this point, we do not wish to sound like Cassandra but merely hope to sound a note of caution for the Committee that in our view the econometric analysis done on this question to date is inconclusive.

In addition to these broad market trends, we believe that there is little reason to be sanguine that political upheavals in one or more of the major oil producing nations will not occur during this decade. At this very moment, the Iran/Iraq war seems to be intensifying and I need not elaborate on the impact that a spread of hostilities to Kuwait, the UAE or Saudi Arabia itself could have on global petroleum supplies. Likewise, we see little reason to be optimistic about the current drift in Arab-Israeli relations and believe that if current trends continue, a crisis of immense proportions could soon be upon us in the Lebanon. Such a crisis will have political ramifications throughout the Arab world and depending on the U.S. response to this crisis could put the last nail in the coffin in effecting the Administration's policy of building a strategic consensus in the Middle East against the Soviet Union.

Finally, we are deeply worried about the impact that falling oil prices may have on the political, economic and social stability of many OPEC and non-OPEC oil producing nations. With rising expectations of a large majority of the populace of these nations now at a fever pitch, the specter of massive shortfalls in petroleum revenue and the attendant impact that this may have on development programs could cause profound dislocations in countries such as Nigeria, Indonesia, Mexico, Algeria, etc. With many of these nations now likely to go into deficit, the poorer nations of the Third World, already in desperate need of new loans from international banks,may find it increasingly difficult to obtain them. The specter of real defaults by several nations will be exacerbated by these developments.

Mr. Chairman, it is only against this larger backdrop of energy and security issues that we believe the subject of Energy Emergency Planning, including SPR policy, can prudently occur. Despite two major and several smaller disruptions to oil supplies since 1973, to date energy contingency planning has not received adequate attention. This I am sorry to note has been particularly true of the Reagan Administration.

The decision to dismantle the Department of Energy has sent the wrong signal to almost everyone - the American people, members of Congress,and perhaps most importantly, to our major allies in Western Europe and Japan. Having just returned from Western Europe, I think it is important for this Committee to understand that it is incomprehensible to European government and industry leaders how the Reagan Administration can argue that the Siberian gas pipeline is a vital alliance energy and security issue, at the same time that the Administration's proposed budget calls for drastic reductions in the fill rate for the SPR, a forty percent reduction in the budget for contingency planning, and an elimination of the Office of International Energy Affairs in DOE, which plays a vital function in U.S. participation in the International Energy Agency.

The European's are incredulous that there is a possibility that if President Reagan vetoes The Standby Petroleum Allocation Act of 1982, and with it the anti-trust exemption allowing U.S. companies to participate in the IEA, that U.S. participation in the IEA will cease. That our major allies could even believe that Congress would not take remedial action to isure active U.S. participation in the IEA shows how dangerous the current drift in U.S./alliance energy relations has become. Likewise, they do not understand how we reconcile spending billions of dollars to defend the oil fields of the Middle East yet refuse to enact more effective and less costly measures at home that will protect us against an energy emergency.

Mr. Chairman, before turning directly to the SPR let me note that the SPR should be viewed as only one element, albeit a critical one, in implementing a much broader energy contingency program. In our recent major energy report, THE CRITICAL LINK: ENERGY AND NATIONAL SECURITY IN THE 1980's, we also advocate (1) a strengthening of the office of energy contingency planning in DOE to include responsibility for all energy emergency planning, both domestic and international, including management and operation of the SPR. The assistant secretary for emergency planning would be responsible for integrating the Federal Emergency Management Agency's crisis management efforts, developing an improved information gathering and dissemination system and chairing an interdepartmental task force drawn from other sectors of the government critical to managing an oil crisis, (2) the provision of financial and technical assistance to state and local energy offices, (3) The establishment of a permanent private-sector task force on Energy and Contingency Planning, (4) a strengthening not a weakening of the federal energy information system, (5) support of IEA efforts to stiffen its demand restraint program and to set more strigent oil import ceilings, (6) the enactment of joint IEA stock drawdown policies, (7) encouraging Mexico to develop an emergency production capacity for oil and natural gas in return for trade concessions and enactment of a guest workers program.

Mr. Chairman, as part of a comprehensive energy emergency plan, I believe the U.S. Government should move to purchase oil for the SPR at the 300,000 b/d target rate sought by Congress in the Omnibus Budget Reconciliation Act of 1981. Under the reduced fill rates proposed by the Reagan Administration, we will not reach the goal set by President Carter (500 million barrels by 1980) until 1986 at the earliest. With oil import levels likely to remain above 5 mmbd throughout this decade, and given the market and political uncertainties I outlined earlier in my testimony, I believe we must move quickly while oil prices are under pressure to insure our security.

As my colleague Mr. Kessler and I argued in Congressional testimony last July,the SPR must be viewed as part of our larger national defense program. This view has recently been reaffirmed by the 1981 report of the National Petroleum Council on Emergency Preparedness and by the House-Senate Conference Report on The Standby Petroleum Allocation Act of 1982. Our own two year report, THE CRITICAL LINK, argues that by all reasonable probability the oil fields of the Persian Gulf can not be protected by the RDF and that measures taken here at home are far more likely to provide us energy security. Only when the SPR is large enough that it can protect our own security, while at the same time providing us with a mechanism to meet our obligations under the IEA emergency oil-sharing mechanism, will the SPR be an effective energy emergency vehicle.

While we sympathize with the Administration's budgetary concerns and understand its desire to postpone expenditures for new salt dome capacity, we dissent with the view that other short-term storage options are not available. Currently, there is over 60 million dwt of VLCC surplus capacity. Even with personnel costs, bunker fuel requirements, etc., this storage capacity could be leased by the U.S. Government at costs ($3-$4.25) not significantly different than the development of new underground storage $3.33/bbl and far below above ground storage costs of $9-$10/bbl in 1981 dollars.

In addition, other short-term storage facilities could comprise the 30 million barrels of privately owned underground storage capacity along the U.S. Gulf Coast. In addition, the API estimates that between 3-4 mmbd of crude oil and an undetermined amount of product storage exists at U.S. refineries. Moreover, given current slack market conditions, various energy marketing companies and other end-users may have additional storage sites available. In short, it appears that some 50-100 million barrels additional capacity may already exist.

In addition, while precise figures are difficult to obtain there is tremendous potential underutilized storage capacity in both the Caribbean (Bonaire, Trinidad, Curaco, Aruba, Puerto Rico, the Bahamas, and in the maritime provinces of Canada. In this regard, it should be remembered that when the SPR was first set up there was legislative authority given both to creating regional petroleum reserves and industrial petroleum reserves. The incorporation of the Caribbean into the SPR system could prove a useful component of our new Caribbean Basin policy. Similarly the development of a regional SPR in Canada could aid New England in the event of another supply disruption.

If all these initiatives were pursued, the SPR could reach its target goal of 500 million barrels by late 1983 to early 1984. With the duration of the oil glut far from certain and some OPEC countries under intense pressure to sell their oil, we believe now is the time to purchase oil for the SPRO. Therefore we dissent from any policy of reducing oil purchases out of budgetary considerations.

Mr. Chairman, while time does not allow me to go into great detail, I would like to call the Committee's attention to some serious problems that must be addressed in implementing an effective SPR policy. These are:

(1) What is the relationship between an activation of the IEA trigger mechanism and the decision to utilize the SPRO?

(2) Does the Administration's policy of relying on the market to allocate supplies during a crisis fulfill the demand restraint policies of the IEA agreement? What role should the SPRO play in meeting supply shortfalls early in a crisis?

(3) Should domestic or IEA obligations receive priority in any SPR drawdown strategy?

(4) How should SPR oil be priced when made available to consumers?

(5) Should access to SPR oil be conditional on commercial concerns, having held a certain prudent level of stocks?

(6) How can we avoid having the SPR become a substitute for privately held commercial stocks?

(7) Should the SPRO be incorporated into a broader IEA wide stock and drawdown policy?

(8) What role should Elk Hills and the NPR in Alaska play in constructing a comprehensive Strategic Petroleum Reserve policy for the nation?

That concludes my testimony Mr. Chairman. I will now be glad to take questions.

Senator **Warner**. That is a good statement, Dr. Ebinger. With some trepidation I ask you a question that the previous witness sought not to answer.

What is your understanding through the grapevine as to why that rate of fill was done? Was it budgetary in fact?

Dr. **Ebinger**. My understanding, Mr. Chairman, as you say, through the grapevine, not being a member of the administration, is exactly that, that it is an overwhelming budgetary consideration.

I guess where I feel very strongly opposed to that is the fact that I find it, as I mentioned in the testimony, difficult to understand how we will cut funds for such a vital part of our emergency energy program at the same time that we appear willing to spend billions of dollars to try to protect access to oil fields in the Middle East, not that one precludes the other, but simply I think it is not a prudent way to pursue public policy.

Senator **Warner**. I am looking through your book. There is a forward in it. I think it is valuable to take an excerpt for the record.

> No country has a right to demand that we remain eternally subject to blackmail. Building a strategic oil reserve is a sovereign decision of the United States on an essential matter of survival. Outside attempts to interfere with our filling of the reserve demonstrate its importance. We should fill our strategic reserve promptly, and any country taking retaliatory steps must know the cost of forfeiting good relations with the United States.

That is, of course, directed at an earlier answer. It does I think very succinctly point up the problem.

In your statement you state that there may be some 50 to 100 million barrels of additional capacity ready for SPR fill today.

In your opinion, how long will it take to utilize this current capacity?

Dr. **Ebinger**. Depending on how fast the Federal branch of the Government could put out a bid statement for leasing, on the basis of the previous testimony, we would think a significant portion of that could be available in say a 30- to 45-day period.

Senator **Warner**. One part of your statement that caused me a little concern is the thought that perhaps we should look to offshore storage, out of country.

What is the origin of that thought?

Dr. **Ebinger**. Well, the origin of that, Senator, is the fact that as you are well aware, there is tremendous transshipment capabilities in some of the Caribbean Islands as well as oil refineries, most of which remain owned by American oil companies, and it is our feeling that a vigorous policy to have oil in storage in these sites, which is our current understanding, that there is significant storage capacity available, at the same time that you have significant refinery capability particularly for residual fuel oil production to move to the east coast, that we feel it would be very prudent to utilize that storage capacity under control of American companies to serve the particular part of the United States which has historically depended on those refiners.

Senator **Warner**. Of course, my concern is facilitating the drawdown, particularly if you were involved in some sort of conflict.

Senator Matsunaga?

Senator MATSUNAGA. Thank you, Mr. Chairman. I, too, wish to commend you, Dr. Ebinger, for your statement. I think you have made cogent observations which seem to be disregarded by the powers that be today.

Now in assessing the feeling abroad, you state that you were in Europe recently?

Dr. EBINGER. Yes, sir.

Senator MATSUNAGA. And your conclusions as expressed in your statement were derived from conversations with what sort of people?

Dr. EBINGER. These were top energy policy planning people, Senator, in the European economic community—the OECD, the International Energy Agency, key industry officials in British Petroleum, Royal Dutch Shell, and CFP in France, as we as leading members of the energy field in the British, Belgium, and French Governments.

Senator MATSUNAGA. So that your statement is based not only on public opinion expressed there, but by opinions expressed by those who have made considerable study of the situation as it exists over there?

Dr. EBINGER. Absolutely, Senator, and I think the interesting thing to note here particularly is how even in industry circles in Western Europe there is intense alarm about the commitment of the U.S. Government to not only emergency policy planning, but to the strategic petroleum reserve, to the IEA, to the point where in the industry itself there is now an active proposal by British Petroleum for the industry to set aside strategic stocks that would only be drawn down in times of an active emergency, and companies would draw out in a sense what they have put in, and I think it is very interesting to see the difference in attitudes that we see sometimes in the oil industry between the companies in Western Europe and Japan and in our own country here at home.

Senator MATSUNAGA. What expressions if any were made about the administration's objection to the completion of the gasline from the Soviet Union down to Western Europe?

Dr. EBINGER. In general, I think it would be fair to say that almost no one we talked to, my colleague and I talked to in Western Europe, was not in support of the Soviet gas pipeline agreement with the possible exception of a few defense planners in France. The general feeling about the administration was that the criticism of the pipeline deal had arisen quite late on in the negotiations, that the types of alternatives that the administration had offered, things like a massive increase in U.S. coal exports, were not viable possibilities because of the fact that we have not developed our coal export capability as rapidly as we might have if we were serious in the European view of aiding them, and a general perception that with the events in the Middle East being what they are, and particularly the much greater gravity with which they are viewed within Western Europe, that even dependency on the Soviet Union if kept to a reasonable level offered an important import diversification policy that no one in Western Europe apparently feels is unduly dangerous to the national security of that region.

Senator MATSUNAGA. I take it from your expressions that you would oppose or you would not favor the opposition to completion of the gas pipeline?

Dr. EBINGER. I think in our major studies, Senator, we do raise very critical comments on the pipeline and argue that it was handled rather badly by both this administration and by the Europeans. I think at this point in time any further opposition to it will only lead to further fissures in the alliance.

I think, however, what we need to begin to think about is making sure that the next pipeline that the Soviets may well have on the docket later this decade, that we take the mechanisms spoken of in Europe in the United States to make sure that this doesn't occur, and what we see happening here is I think we have got to pay a lot more attention to the prospects offered by Norwegian gas development. I think we have got to get our coal export house in order so to speak, and I think we need to sit down with our allies and work out a concerted policy of our whole attitude not only in energy trade with the East bloc, but in our other strategic trades, but it is difficult, of course—I know you have heard this argument undoubtedly—for the Europeans to take our options to the Siberian gas pipeline seriously when we either are not taking in their view seriously energy matters here at home, or alternatively when we continue to provide grain to the Soviet Union which in the European view is no less strategic than gas pipeline agreements.

Senator MATSUNAGA. So that we would need to move more rapidly in the area of providing energy self-sufficiency here at home even to the point of being exporters of energy?

Dr. EBINGER. Absolutely, and I think it is important to note that there is deep concern in Western Europe at what they hear emanating out of Washington, namely, the perception of a total reliance on the free market, that this may weaken the U.S. commitment to the International Energy Agency in the event of a crisis, that if we are pursuing free market strategies at home, will we be any more willing to engage in an allocation strategy within the IEA agreement, and because of certain statements that have been made by certain administration officials, there is deep alarm in Western Europe that we may even withdraw from the IEA.

Senator MATSUNAGA. Thank you very much.

Senator WARNER. We thank you very much, Doctor. It was very helpful.

Dr. EBINGER. Thank you, Senator.

Senator WARNER. Mr. Dexter Peach—Mr. Peach is Director, Energy and Materials Division, General Accounting Office.

Mr. Peach, we will put your statement in its entirety in the record. Perhaps you could summarize some of the parts. You have the benefit of prior witnesses. I think the issues are fairly well drawn on this question.

STATEMENT OF J. DEXTER PEACH, DIRECTOR, ENERGY AND MINERALS DIVISION, GENERAL ACCOUNTING OFFICE, ACCOMPANIED BY FLORA MILANS, GROUP DIRECTOR, GENERAL ACCOUNTING OFFICE, AND RIC CHESTON, EVALUATOR, GENERAL ACCOUNTING OFFICE

Mr. PEACH. Having heard the testimony so far, there are a few points that I would like to emphasize, Senator, in my statement.

First, let me introduce my colleagues at the table. On my right is Ms. Flora Milans who is the group director responsible for the work we have done on the strategic petroleum reserve, and Mr. Ric Cheston on my left, who has been principally involved in much of that work as one of our evaluators.

We have done a lot of work on both emergency preparedness and on the strategic petroleum reserve. Members of this committee were instrumental in having us review the status of the reserve over the last year and a half and issue a series of monthly reports and a December 1981 summary report.

In addition, we have issued severals reports recently dealing in some detail with the status of emergency planning within the administration. I want to talk briefly about three areas—the size of the SPR, the capacity constraints, and oil quality, but allow me first to give some brief comments on the overall status of emergency planning which I think can help place the SPR issues in some perspective.

Our work on emergency preparedness can be summarized in one sentence. Except for the buildup of the SPR, which was undertaken largely as a result of congressional interest, the United States is no better prepared to deal with a major oil disruption now than it was during the 1973 oil embargo, and almost all other energy emergency preparedness efforts are in various states of disarray.

Our work has convinced us that the Nation needs a balanced energy emergency preparedness program which judiciously blends reliance on private markets with Government programs. The SPR is, of course, the keystone of the kind of programs we should have.

Questions about SPR size have significant budget and national security implications, and directly relate to decisions which need to be made regarding SPR storage capacity over the next several years. In a moment I will comment on the capacity issues. The SPR does not have to be sized to met supply shortfalls on a barrel-for-barrel basis. The SPR can be supplemented by a number of emergency preparedness measures, such as (1) existing industrial stocks; (2) fuel switching; (3) restraining demand on both voluntary and mandatory bases; (4) creating an industrial petroleum reserve; or (5) using political, military, or economic leverage to affect the size and duration of the shortfall.

As our work on overall energy emergency preparedness indicates, however, it remains to be seen whether we are going to have plans developed in any of these areas and put in place in some or all of them.

The question of the appropriate size of the SPR is directly related to assumptions about possible energy emergencies and the adequacy of other energy emergency preparedness measures. If the SPR is the only significant insurance the Nation has against an oil import disruption, the argument for a larger reserve is strengthened, but have other well-developed emergency plans exist, then the argument for the currently planned 750 million-barrel or even a smaller reserve would be strengthened.

As required by the Omnibus Budget Reconciliation Act of 1981, DOE is studying options for changing the size of the current 750-million-barrel reserve and now promises the results of that study by May 1, 1982.

Overall, given the significant budgetary and national security implications, both the administration and the Congress must ultimately make the judgment concerning how much insurance the SPR should provide and how fast progress should be made toward achieving that end.

That brings me to the issue of SPR capacity. While DOE's progress over the past 17 months has been commendable, it is aporoaching the limits of its available storage capacity. Currently, DOE's fill rate is tied to the rate at which underground storage capacity can be created. Because of the long leadtimes required to add such capacity, funding and program decisions made now can dictate the volume of oil that can be added and the completion date for the SPR.

DOE has not fully examined options for accelerating the availability of the storage capacity; although, as DOE testified this morning, it is beginning to take some action in this area. In July 1981, DOE looked at options for increasing the permanent size of the reserve and assumed that the schedule for completing a 750-million-barrel reserve would be maintained. DOE did not consider other options such as leasing temporary storage space, substituting above ground storage tanks for part of its planned underground capacity, or completing a smaller sized reserve.

Very recently we developed estimates of the costs associated with leasing existing above ground steel tanks or oil tankers to achieve a 300,000-barrel-per-day fill rate goal as specified by Congress in the Omnibus Budget Reconciliation Act of 1981. The details of those estimates are attached to my statement. In summary, based on price ranges provided by DOE and industry groups, we estimate that if the fill rate of 300,000 barrels per day is to be maintained until the first 500 million barrels are stored, DOE would need to lease varying amounts of storage space over a period of about 4 years. Temporary storage needs would range from about 42 million barrels in fiscal year 1982 to 83 million barrels in fiscal year 1984, and the total cost would range from about $471 to $523 million for steel tanks, and from about $785 to $954 million for oil tankers.

If a 300,000-barrels-per-day fill rate is maintained until 750 million barrels are stored, the total leasing cost would be significantly higher and would be incurred for fiscal years 1982 to 1989. DOE would need to lease storage space ranging from 42 million barrels in fiscal year 1982 to a peak of 209 million barrels in fiscal year 1986. Total cost would be about $1.8 to $2 billion for steel tanks, and $2.9 to $3.6 billion for oil tankers. All these figures are in constant 1982 dollars.

Under either case, in fiscal year 1983 if Congress wishes to maintain the 300,000-barrel-per-day fill rate, about 75 million barrels of temporary capacity would be needed at a cost of $135 to $150 million for steel tanks, and $225 to $274 million for oil tankers. I use these estimates to give you some parameters for the 1983 SPR budget, if the Congress choses to accelerate the fill rate through interim storage.

As you heard earlier, DOE has initiated action through a request for proposals to gather information as to what kind of storage capacity may exist, but DOE has made no commitment to an interim storage program yet. I will not detail the recommendations in our December 1981 report. Essentially we reported on what needs to be done to achieve a 300,000-barrel-per-day fill rate in order to provide the information for the Congress to make a judgment as to how to proceed.

In February, the administration announced the deferral of $53 million in fiscal year 1982 funds associated with the development of the new 140-million-barrel facility at Big Hill, Tex. The deferral would modify the phase 3 expansion plans by stretching the completion date for a 750-million-barrel SPR by 1 year to the end of 1990. This would not affect planned SPR capacity and resulting fill rates until 1987. Then additions to capacity would drop by 13 million barrels.

In fiscal year 1988, the deferral would allow DOE to add only 25 million barrels new capacity, with a resulting fill rate of only 68,000 barrels per day during that year. This is about 32,000 barrels per day less than the minimum 100,000-barrel-per-day fill rate required by the Energy Security Act.

Mr. Chairman, there has been some discussion earlier this morning about DOE's fiscal year 1983 SPR budget request. DOE's October budget request to OMB was $1.4 billion, including $796 million for oil acquisition and transportation. As we understand it, in response to OMB's request that DOE make additional budget cuts, DOE proposed to fill the SPR at a rate of about 100,000 barrels per day for fiscal years 1983 and 1984. OMB set the final budget level at a little above $2.3 billion. This would provide enough funds to fill the SPR to capacity in fiscal year 1983, plus leave money to buy oil for the ensuing year.

An issue worth exploring, and I have no information on this, is the decision to defer the 140-million-barrel Big Hill site. There is no final decision on the size of the reserve, and DOE's size report will not be released until May. There may be a connection between the decision to defer the development of Big Hill and the final decision on the size of the reserve. The administration may be considering an SPR that is somewhat less than the 750 million barrels now planned.

Also, I would like to make one brief point about an issue that has not been discussed at the hearings that I think would be worth the committee's attention. This is the question of oil quality. DOE's original crude oil quality specifications and oil acquisition strategy were based on a 1976 assessment of the refinery product needs and capabilities. During fiscal year 1981, DOE modified its acquisition strategy to accept Alaskan North Slope and Mexican crudes that are heavier than the oil previously purchased without conducting a similar assessment.

As of February 28, 1982, about 51 million barrels, or 21 percent of the 241 million barrels of oil that the SPR had received, were the heavier crudes. That percentage could change, and we do not believe that the likely impact of using a heavier mix of crude has been fully analyzed.

DOE has stated in commenting on our December 1981 report that we exaggerated the risk of storing heavy, high sulfur crude and that the Department's plans call for less than 10 percent of the total crude storage to be heavy, high sulfur crude. It is currently at the 21-percent level, and depending on decisions on the ultimate size of the reserve and continued purchases, there is some question whether DOE will be able to adhere to the planned ratio of heavier crudes.

To conclude my testimony, Mr. Chairman, let me highlight our overall points.

The SPR is vital to the Nation's efforts to increase the oil available for emergency use and protect itself against oil supply disruptions.

The progress to fill the SPR in the last 17 months is commendable, but DOE is now approaching the limits of its available underground storage capacity and will find it increasingly difficult to achieve a fill rate consistent with the existing congressional goals.

Because of the long leadtime required to construct underground storage, Congress needs to address the size of the SPR and storage alternatives now, in the context of the desired program objectives and funding levels. SPR size cannot be considered in isolation. Rather, judgments on size must be related to the availability and adequacy of other emergency preparedness efforts.

Storage alternatives which would accelerate SPR oil fill have significant budgetary implications because they spread oil acquisition and facility construction costs over fewer years and necessitate higher funding levels in those years. This, of course, must be traded off against the national security benefits which could result from early completion of the SPR.

That concludes my statement, and we will be pleased to answer any questions.

[The prepared statement of Mr. Peach follows:]

UNITED STATES GENERAL ACCOUNTING OFFICE
WASHINGTON, D.C. 20548

FOR RELEASE ON DELIVERY
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STATEMENT OF
J. DEXTER PEACH, DIRECTOR
ENERGY AND MINERALS DIVISION
BEFORE THE
SUBCOMMITTEE ON ENERGY AND MINERAL RESOURCES
OF THE
SENATE COMMITTEE ON ENERGY AND NATURAL RESOURCES
ON
THE STRATEGIC PETROLEUM RESERVE

Mr. Chairman and Members of the Subcommittee:

We welcome the opportunity to discuss GAO's work on the Strategic Petroleum Reserve (SPR) program. We have had a continuing interest in the SPR for quite some time and have issued numerous reports which addressed the progress and problems associated with its development. My testimony will focus on issues concerning

--the size of the SPR,

--capacity constraints, and

--oil quality.

These issues are covered in more detail in our December 1981 report 1/ on the SPR.

To place the specific SPR issues in perspective, I would like to briefly discuss GAO's recent work regarding energy emergency preparedness at the Federal level. In September 1981, we issued a

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1/"Strategic Petroleum Reserve: Substantial Progress Made, But Capacity and Oil Quality Concerns Remain" (EMD-82-19, Dec. 31, 1981).

comprehensive evaluation 1/ of DOE energy emergency preparedness efforts and just recently, at the request of the Chairman of the House Subcommittee on Fossil and Synthetic Fuels, issued a follow-up report 2/ taking into consideration the fiscal year 1983 budget proposals for energy emergency preparedness. Our work can be summarized in one sentence. Except for the recent buildup of the SPR, undertaken largely as a result of congressional interest, the United States is no better prepared to deal with a major oil disruption now than it was during the 1973 oil embargo, and almost all other energy emergency preparedness efforts are in various states of disarray.

Our work has convinced us that the Nation needs a balanced energy emergency program, one which judiciously blends reliance on private oil markets with Government programs. Such a program would greatly limit the serious economic damage which oil import disruptions can cause. The SPR is the keystone for this type of program and is vital to the Nation's efforts to protect itself against such a disruption.

As of March 8, 1982, the SPR contained about 243 million barrels of oil. This amount currently could be withdrawn at about 1.7 million barrels per day for about 3-1/2 months, at which point the drawdown rate would decrease until the SPR is exhausted about 3 months later. Even though the SPR can currently provide some relief

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1/"The United States Remains Unprepared for Oil Import Disruptions" (EMD-81-117, Sept. 29, 1981).

2/"The Effects of the Fiscal Year 1983 Budget, Energy Reorganization, and Program Changes on U.S. Energy Emergency Preparedness" (EMD-82-45, Mar. 9, 1982).

from an oil supply disruption, specific plans have not yet been developed for its use during an emergency. We believe a specific SPR use plan should be developed to avoid ad hoc decisionmaking during a crisis. This use plan should be integrated with energy emergency preparedness plans.

SPR SIZE

The question of SPR size has significant budget and national security implications and directly relates to decisions which need to be made regarding SPR storage capacity over the next several years. I will comment in detail on the capacity issue in a moment.

In 1979, when DOE was calling for a 1-billion-barrel SPR by 1985, we reported 1/ that no study had shown that 1 billion barrels is the optimum-sized reserve. Further, DOE gave a low probability to the possibility of a future supply disruption which would require a 1-billion-barrel reserve. In addition, we pointed out that the reserve does not have to be sized to meet supply shortfalls on a barrel-for-barrel basis. It can be supplemented by such measures as:

--using existing industry stocks;

--fuel switching;

--restraining demand or managing supplies through conservation or allocation;

--creating an industrial petroleum reserve; or

--using political, military, or economic leverage to affect the size and duration of the shortfall.

1/"Factors Influencing the Size of the U.S. Strategic Petroleum Reserve" (ID-79-6, June 15, 1979).

As our work on overall energy emergency preparedness indicates, however, it remains to be seen whether plans will be developed and put in place in some or all of these areas.

The question of the appropriate size of the SPR is directly related to assumptions about possible energy emergencies and the adequacy of other emergency preparedness measures. If the SPR is the Nation's only significant insurance against an oil import disruption, the argument for a larger reserve is strengthened. But, if other well-developed emergency plans exist, the argument for the currently planned 750-million-barrel or an even smaller reserve is strengthened. As required by the Omnibus Budget Reconciliation Act of 1981, DOE is studying options for changing the current 750-million-barrel reserve and now promises the results of its study by May 1, 1982.

Given the significant budgetary and national security implications, the administration and the Congress must ultimately make the judgments concerning how much insurance the SPR should provide against an oil supply disruption and how fast progress should be made toward achieving that end.

CAPACITY CONSTRAINTS

That brings me to a key issue raised in our December 1981 SPR report--capacity constraints facing the SPR.

During fiscal year 1981, the administration far surpassed the required minimum 100,000-barrels-per-day fill rate of the Energy Security Act of 1980 and almost met the higher 300,000-barrels-per-day goal of the Omnibus Budget Reconciliation Act of 1981 by adding to the SPR at an average rate of about 292,000 barrels per day.

This is by far the highest fill rate achieved for any fiscal year since oil fill began. The previous high fill rate was 165,000 barrels per day during calendar year 1978. By the end of fiscal year 1981, the SPR contained about 199 million barrels of oil, more than twice the 93 million barrels that were in the SPR at the beginning of the year.

So far during fiscal year 1982, the SPR fill rate has averaged about 277,000 barrels per day. As of March 8, 1982, the reserve contained about 243 million barrels of oil, or about 32 percent of the planned 750-million-barrel capacity.

While DOE's progress in filling the SPR over the past 17 months has been commendable, DOE is now approaching the limits of its available storage capacity. Currently, DOE's fill rate is tied to the rate at which underground storage capacity can be created. Because of the long lead time required to add such capacity, funding and program decisions made now can dictate the volume of oil that can be added and the completion date for the SPR.

The effects of capacity constraints have already become obvious. In January 1982, DOE decided to delay purchasing additional oil for the SPR until the third quarter of fiscal year 1982 because of storage capacity limitations. Ironically--and unfortunately--this delay in oil purchases comes at a time when there is a surplus of oil on the world market at relatively favorable prices. As you know, major oil producing countries in recent weeks have cut their prices and the spot market price for Arabian light crude has dropped to about $29 per barrel.

The delay further underscores the matters discussed in our report concerning the availability of storage capacity and the need for DOE to consider further the costs and benefits of alternatives to its current capacity expansion plans, including leasing existing storage capacity on a temporary basis, or substituting above ground storage tanks for part of its planned underground capacity.

Options to accelerate the availability of capacity

DOE has not fully examined options for accelerating the availability of storage capacity. In July 1981, DOE considered options which increase the permanent size of the reserve and assumed that the schedule for completing a 750-million-barrel reserve would be maintained. DOE's study did not consider other options such as leasing temporary storage space, substituting above ground steel tanks for part of its planned underground capacity, or completing a smaller sized reserve.

As pointed out in our December 1981 report, DOE may be able to lease existing storage capacity to increase the SPR's oil fill capability while long-term storage capacity is being developed. Existing capacity may be available in the form of above ground steel tanks, oil tankers, or underground caverns.

Recently we developed estimates 1/ of the costs associated with leasing existing above ground steel tanks or oil tankers to achieve the 300,000-barrels-per-day fill rate goal.

Details of these estimates are attached to my statement. In summary, based on price ranges provided by DOE and industry groups, we estimate that, if a fill rate of 300,000 barrels per day is to

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1/"Leasing Storage Capacity for the Strategic Petroleum Reserve" (EMD-82-62, Mar. 12, 1982).

be maintained until the first 500 million barrels are stored, DOE would need to lease varying amounts of storage space over a period of about 4 years. Temporary storage needs would range from about 42 million barrels in fiscal year 1982 to 83 million barrels in fiscal year 1984. The total cost could range from about $471 million to $523 million for steel tanks and from about $765 million to $954 million for oil tankers.

If the 300,000-barrels-per-day rate is to be maintained until 750 million barrels are stored, total leasing costs would be significantly higher and would be incurred from fiscal years 1982 through 1989. DOE would need to lease storage space ranging from 42 million barrels in fiscal year 1982 to a peak of about 209 million barrels in fiscal year 1986. Total costs involve about $1.8 billion to $2.0 billion for steel tanks and about $2.9 billion to $3.6 billion for oil tankers.

Under either case, in fiscal year 1983, if the Congress wishes to maintain this fill rate, about 75 million barrels of temporary capacity would be involved at a cost of $135 million to $150 million for steel tanks and $225 million to $274 million for oil tankers.

Although DOE has discussed leasing storage space with several companies, until recently it did not pursue the leasing option because it intended to fill the SPR at the rate allowed by its expansion plans. We understand that DOE recently initiated actions to obtain a better understanding of the amount of storage capacity that may be available for leasing. On February 10, 1982, DOE issued a Request for Proposals that asked interested companies with available storage capacity to indicate whether they would be willing to lease capacity to DOE for a 6- to 12-month period.

We believe that DOE should more fully assess the costs and benefits of alternatives to its current expansion plans which would allow it to achieve a fill rate consistent with congressional goals. We recommended in our December 1981 report that the Secretary of Energy evaluate options for achieving an average annual fill rate of 300,000 barrels per day, assuming the planned or other SPR sizes. Also we recommended that DOE assess the costs and benefits of alternatives to its current plans. Because of the budgetary implications, the evaluation should be available for congressional deliberations on the fiscal year 1983 budget and should assess the costs and benefits of alternatives to constructing new underground storage facilities.

We further suggested that the Congress explore with DOE the capacity expansion plans and options to achieve an average fill rate of 300,000 barrels per day until the SPR is filled and reaffirm or provide new guidance on its desired fill rate.

DEFERRAL OF FISCAL YEAR 1982 SPR FUNDS FOR THE BIG HILL STORAGE SITE

On February 5, 1982, the administration announced the deferral of $53 million of fiscal year 1982 funds associated with the development of the new 140-million-barrel Big Hill, Texas, storage site. This deferral would, in effect, modify DOE's Phase III expansion plans by stretching the completion date for the 750-million-barrel SPR by 1 year to the end of fiscal year 1990. Because of the long lead times involved in developing a new underground storage site, this proposal will not affect the planned SPR capacity and resulting fill rates until fiscal year 1987. Then additions to capacity would drop by 13 million barrels. In fiscal year 1988, the deferral would allow DOE to add only 25 million barrels of new capacity and result in a fill rate of only 68,000 barrels per day during the year, or about 32,000 barrels per day less than the minimum 100,000-barrels-per-day rate required by the Energy Security Act.

OIL QUALITY CONCERNS

Let me briefly turn to our concerns regarding the quality of the oil being purchased by DOE. Since oil acquisition for the SPR resumed in October 1980, DOE has purchased a large quantity of heavier crude oil. Because of the refinery yields of various grades of crude oil, the quality of the SPR oil is an important determinant of the amount of specific petroleum products available to the Nation during an oil supply disruption.

DOE's original crude oil quality specifications and oil acquisition strategy were based on a 1976 assessment of refinery product needs and capabilities. DOE modified its acquisition strategy during fiscal year 1981 to accept Alaskan North Slope and Mexican crudes that are heavier than oil previously purchased without conducting a similar assessment. Although DOE awarded a $258,000 contract in May 1981 to perform such an analysis, the study will not be completed until August 1982. In the interim, DOE has continued to purchase lower quality oil without the needed analysis. In January, DOE purchased about 1.6 million barrels of Alaskan North Slope oil.

By February 28, 1982, about 51 million barrels--about 21 percent--of the 241 million barrels of oil that the SPR had received were heavier crudes. Depending on the ultimate size of the reserve and the amount of heavier crude oil it contains, this percentage could change. Consequently, the likely impact of the heavier crudes on the mix of oil products which might be available is not known at this time.

In our December 1981 report, we recommended that DOE document the rationale for future reductions in the quality specifications for SPR oil and make a determination whether the SPR oil quality specifications should be revised. The results of the SPR size study and the ongoing study of oil quality should be useful in making that determination.

In its March 9, 1982, comments on this aspect of the report, DOE stated that we exaggerated the risks of storing heavy, high-sulfur crude oil. While DOE stated that its plans call for less than 10 percent of the total crude stored to be the heavy, high-sulfur type, as I just noted, already about 21 percent of the reserve is the heavier crudes. Depending on decisions on the ultimate size of the reserve and continued purchases, DOE may not be able to adhere to its planned ratio of heavier crudes. Because the oil quality is an important determinant of the products which could be available, we continue to believe further attention is warranted in this area.

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In summary, Mr. Chairman:

--The SPR is vital to the Nation's efforts to increase the oil available for emergency use and to protect itself against oil supply disruptions.

--Although much progress has been made during the last 17 months to fill the reserve, DOE is now approaching the limits of its available underground storage capacity and will find it increasingly difficult to achieve a fill rate consistent with existing congressional goals.

--Because of the long lead time required to construct underground storage, the Congress needs to address the size of the SPR and storage alternatives now in the context of desired program objectives and funding levels. The SPR size cannot be considered in isolation; rather judgments on size must be related to the availability and adequacy of other emergency preparedness efforts.

--Storage alternatives which would accelerate SPR oil fill have significant budgetary implications because they spread the oil and facilities' costs over fewer years and necessitate higher funding levels in those years. This, of course, must be traded off against the national security benefits which could result from early completion of the SPR.

--DOE's practice of purchasing some heavier crudes for the SPR should be monitored closely and, if necessary, modified to ensure that the oil in the SPR will yield the specific products needed by the Nation during an oil supply disruption.

This concludes my statement, Mr. Chairman. I would be happy to respond to questions.

Table 1

Leasing Costs to Achieve the 300,000-Barrels-Per-Day Fill Rate Goal Until 750 Million Barrels are in the SPR

(By Fiscal Year)

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	Total
Oil Storage Requirements											
	-(millions of barrels)-										
Permanent Storage (FY 1983 Budget)	199	267	343	417	456	538	598	623	670	750	
Leased Temporary Storage (note a)	--	41.5	75	110.5	181	208.5	152	127	80	--	
Total SPR Storage	199	308.5	418	527.5	637	746.5	750	750	750	750	
Cost of Leased Temporary Storage (note b)											
Above Ground Steel Tanks		-(millions of constant 1982 $)-									
Assuming $1.80/barrel/year (note c)		75	135	199	326	375	274	229	144	--	1,757
Assuming $2.00/barrel/year (note d)		83	150	221	362	417	304	254	160	--	1,951
Oil Tankers (note e)											
Assuming $3.00/barrel/year (note f)		125	225	332	543	626	456	381	240	--	2,928
Assuming $3.65/barrel/year (note g)		151	274	403	661	761	555	464	292	--	3,561

a/The total temporary storage needed to fill the SPR at a rate of 300,000 barrels per day is 975.5 million barrels. It is assumed that temporary storage is needed for each full year; however, the actual capacity requirements would vary depending on deliveries.

b/Does not include transportation costs.

c/DOE officials stated in December 1981 that they believe DOE could lease between 10 million and 30 million barrels of capacity at a monthly cost of about 15 cents per barrel.

d/In testimony before the Subcommittee on Fossil and Synthetic Fuels on March 2, 1982, a representative of the Independent Fuel Terminal Operators Association cited a figure of $2 per barrel per year as a rate at which members of the association would be willing to lease space.

e/According to H. P. Drewry's monthly report on "Shipping Statistics and Economics", worldwide there are 164 oil tankers of at least 100,000 deadweight tons (DWT) that are inactive--primarily either laid up or being used for oil storage. One DWT is equivalent to 7.3 barrels of storage capacity for Arabian Light oil. According to the Drewry monthly reports and the Journal of Commerce, leasing rates for large tankers have generally ranged from $11,000 to $13,000 per day.

f/Representatives of the Petroleum Industry Research Foundation and the Transportation Institute cited $3 per barrel per year for leasing oil tanker storage capacity in testimony before the Subcommittee on Fossil and Synthetic Fuels on March 2, 1982. This is equivalent to tankers with an average size of 200,000 DWT (1.46 million barrels) leased for $12,000 per day, or about 0.8 cents per barrel per day.

g/GAO calculation based on an assumption of an average size of 150,000 DWT (1.095 million barrels) leased for $11,000 per day, or 1.0 cent per barrel per day.

Table 2

Leasing Costs to Achieve the 300,000-Barrels-Per-Day Fill Rate Goal Until the First 500 Million Barrels are in the SPR

(By Fiscal Year)

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	Total
Oil Storage Requirements	-(millions of barrels)-										
Permanent Storage (FY 1983 Budget)	199	267	343	417	456	538	598	623	670	750	
Leased Temporary Storage (note a)	--	41.5	75	83	62	--	--	--	--	--	
Total SPR Storage	199	308.5	418	500	h/518	538	598	623	670	750	
Cost of Leased Temporary Storage (note b)											
Above Ground Steel Tanks		-(millions of constant 1982 $)-									
Assuming $1.80/barrel/year (note c)		75	135	149	112						471
Assuming $2.00/barrel/year (note d)		83	150	166	124						523
Oil Tankers (note e)											
Assuming $3.00/barrel/year (note f)		125	225	249	186						785
Assuming $3.65/barrel/year (note g)		151	274	303	226						954

a/The total temporary storage needed to fill the SPR at a rate of 300,000 barrels per day is 261.5 million barrels. It is assumed that temporary storage is needed for each full year; however, the actual capacity requirements would vary depending on deliveries.

b/Does not include transportation costs.

c/DOE officials stated in December 1981 that they believe DOE could lease between 10 million and 30 million barrels of capacity at a monthly cost of about 15 cents per barrel.

d/In testimony before the Subcommittee on Fossil and Synthetic Fuels on March 2, 1982, a representative of the Independent Fuel Terminal Operators Association cited a figure of $2 per barrel per year as a rate at which members of the association would be willing to lease space.

e/According to H. P. Drewry's monthly report on "Shipping Statistics and Economics", worldwide there are 164 oil tankers of at least 100,000 deadweight tons (DWT) that are inactive--primarily either laid up or being used for oil storage. One DWT is equivalent to 7.3 barrels of storage capacity for Arabian Light oil. According to the Drewry monthly reports and the *Journal of Commerce*, leasing rates for large tankers have generally ranged from $11,000 to $13,000 per day.

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g/GAO calculation based on an assumption of an average size of 150,000 DWT (1.095 million barrels) leased for $11,000 per day, or 1.0 cent per barrel per day.

h/The additions to storage reflect deliveries of 50,000 barrels per day under the 5-year contract with PEMEX, Mexico's State oil company. These deliveries would require additional storage capacity over the previous fiscal year.

Senator WARNER. Very well. I will take note that you have, I understand, confirmed the position in the Congress on S. 1503 is a wise one and that should become law?

Mr. PEACH. Yes, Mr. Chairman. As a part of the overall emergency preparedness work that we have done, we believe that standby allocation authority is reasonable. I should note that we did do a review of how the allocation system worked after the Iranian shortfall. We found it was a chaotic experience. We also found that the program that was ready to be placed into action at that time had known deficiencies and known problems which had not been corrected. It was not well thought out, and so there were many problems that could be remedied by better planning.

We point out in our report that there are problems when you move fully to price controls or rationing. We would try to look at the simplest kind of standby allocation measures possible. The question is whether it could be limited to just crude oil. Based on past experience, there is likely to be a demand for additional Government intervention in the face of a severe shortage. It is better to plan ahead of time rather than waiting until after the emergency occurs before beginning to think about appropriate responses.

Senator WARNER. Perhaps you are aware of the letter sent by members of this committee to Mr. Bowsher thanking him and his predecessors for the valuable advice given by your organization to this committee.

It is our hope that this will continue perhaps on an increased intensity.

Mr. PEACH. I was aware, Mr. Chairman. I knew my staff had been having discussions with members of the committee staff, and we plan to continue working closely with you.

Senator WARNER. How long have you been there?

Mr. PEACH. I have been with the GAO over 22 years, sometimes longer than I like to count.

Senator WARNER. Mr. Bowsher and I were associated for many years at the Department of the Navy, and you will find him a very fine associate.

Mr. PEACH. I was aware of this, and I told him I would be very careful here today, and try to do a good job testifying.

Senator WARNER. That you have done. Senator Matsunaga?

Senator MATSUNAGA. Thank you, Mr. Chairman. I want to commend you, Mr. Peach, for your statement and for the report which was put out by your office on December 31, of last year. I think it gives the Congress guidelines by which we definitely ought to proceed.

I notice in your oral testimony in summarizing you omitted the last item. Was that for any reason, the last item, DOE's purchasing some heavier crudes for the SPR should be monitored closely?

Mr. PEACH. I omitted that point because it was the last thing that I had discussed in the testimony. We believe the quality of oil purchased for the SPR is important. it is an area that we should continue to monitor because of the percentage of heavier crudes now represented in the SPR inventory. If the percentage should continue to remain high, the question of how those heavier crudes fit in with the Nation's refinery capability and product needs would have to be examined very carefully.

Senator **Matsunaga**. It was not a change of mind?

Mr. **Peach**. That is correct.

Senator **Matsunaga**. I believe this is very important, especially in our lack of preparation to deal with heavy crudes coming out of Alaska and Mexico. Why should we not immediately proceed to build facilities which would process the heavier crude to produce the type of product that we can actually use?

Mr. **Peach**. Let me say, Senator, I wouldn't want to make more out of this than I have at this point. As we have used more Alaskan North Slope oil in this country, there has been a greater ability of refineries to process it. Because Alaskan North Slope oil is a heavier crude, you get a different refinery product mix—a lower yield of lighter products, such as gasoline and jet fuel, and more heavier products.

However, the Maya crude, which is part of the long-term contract with PEMEX—the Mexican state oil company—is extremely heavy oil. The extent of U.S. refineries' capabilities to process Maya crude and the resulting product mix that would be available in the event of an oil supply interruption. I am concerned about whether we will have the right product in the right places.

Senator **Matsunaga**. For that reason, I am disturbed by you finding that 21 percent of the SPR now consists of the type of heavy crude you speak of. We may not be able in case of an emergency to avail ourselves of the use of that.

Mr. **Peach**. That could be the concern for some of the products refined from these crudes, and I think any decision on changing the quality of the crude that DOE is acquiring should be well documented and justified.

Senator **Matsunaga**. Thank you very much.

Senator **Warner**. In the interest of time we will have to proceed now to our last panel. Mr. David Montgomery, Resources for the Future—Mr. Montgomery, thank you for taking your time to come to provide us with an insight at this point.

STATEMENT OF W. DAVID MONTGOMERY, SENIOR FELLOW, CENTER FOR ENERGY POLICY RESOURCE, RESOURCES FOR THE FUTURE

Mr. **Montgomery**. Thank you, Mr. Chairman. I was honored to be invited to come and talk to you today. I am a senior fellow for the Center for Energy Policy Research at Resources for the Future. If you will indulge me, let me mention that Resources for the Future is a nonprofit, tax-exempt research organization which as an institution takes no position on policy issues. I appear at your invitation and I represent only myself.

I have a prepared statement which I would like to submit for the record and summarize it briefly now.

At Resources for the Future we have been working for the past year on research projects aimed at understanding the impact of oil· disruptions on the economy and the nature of the measures that could mitigate that impact.

In working on that project, I have looked at I think considerable economic research that has been done on import policy over the past few years, and I thought what I could most usefully do today is try to distill some of that research in principles that I feel are useful for guiding thinking about the strategic petroleum reserve.

I will begin by focusing on an issue that has not been discussed much today which is the role of private stockpiles in the private sector in preparing for an energy emergency by looking at two related questions—first of all, what are the reasons for a public interest in having a large stockpile, and second, why are private stockpiles held and how well would the level of those stockpiles comport with the public interest?

This is a complicated argument which is laid out in my prepared statement and which I will not go into deeply today, but it does produce what I think are some simple results. The first conclusion that I draw is that there is a public interest in stockpiling, that the reason for that public interest is the ability of a strategic petroleum reserve to moderate the price runoff that we would otherwise face in the event of a major oil supply disruption. That moderating of this price runup provides us with two benefits to the economy that we cannot expect private parties to look at and capture. One of them is simply the benefits of preventing the price runup itself. The private parties cannot benefit from prices that don't occur in the market and prices at which they cannot sell the oil from their reserves.

The second benefit which only the Government recognizes, I believe, is an ability to moderate the macroeconomic consequences of an oil supply disruption, the loss of total output, the loss in employment that results from a sudden shock to the economy. This again is a cost which the strategic petroleum reserve can moderate, but again, it does so through its ability to influence the runup in the world price.

I have looked also at the question of who should hold the strategic petroleum reserve, and there I believe that the conclusion that there is a public interest in having a strategic petroleum reserve does not necessarily imply that only the Government should hold the reserve. I think that in the long run we probably could devise some workable incentives which would bring about holding of adequate stocks in the private sector but I think it would also take some time to do that. It is not a simple problem, and it is certainly not one that would occur quickly.

I agree with all of the other panelists today that I have heard, and I think with the members of the committee that now is the time to purchase oil for this strategic petroleum reserve, to add to our reserves, and if that is the case, I see no option except the Government purchasing it now, though perhaps in the longer term there would be other methods by which we could provide incentives for private purchases.

Let me dwell briefly on the reason why I believe the private sector will not hold adequate petroleum stocks. Adding to oil reserves, whether they are public or private, involves a tradeoff between a certain cost that is incurred now of purchasing the oil and storing it against an uncertain prospect of some future benefit. The private parties will see this tradeoff in one way, will look at the price of oil now and compare it to the expected appreciation in the price of oil. That expected appreciation must exceed what it costs to store the oil over some period of time. I would argue that the price of oil underestimates the social cost to our economy of imports now so that in a sense the Government faces a higher cost in purchasing oil than the private sector does.

We may impose some pressure on world oil prices at some point in time. That was a concern a few years ago that I think it probably is not a real concern now. I doubt that Government purchases for the strategic petroleum reserve would in any way bail the oil suppliers out of the glut that they are facing now. In the future, though, during oil supply disruption, I think there is a very large difference between the benefits which will accrue to society from being able to displace oil imports and restore consumption through use of the reserve. There is a very big difference between this benefit to society and the price which any individual holder of stocks could receive by selling the oil.

Senator WARNER. Do you have an opinion on the ultimate size?

Mr. MONTGOMERY. I have not done any research on that myself, but I do have an opinion. The reason why I haven't done any research on the subject myself is because over the past few years I have read a number of studies that were done by people who I respected that came up with estimates of an ultimate size that was 1 billion barrels running on up, depending on one's degree of pessimism. I think that the ultimate size—all sizes were much larger than any I ever expected to see, and therefore I didn't think I would accomplish much by trying to refine those numbers anymore, and I think the same is still the case. No matter how we adjust those studies for possible short-term softness in the world market and a possibly safer situation for a couple of years, there is no way to bring that ultimate size of the reserve down to anything like what we have today, so my guess would be it might be less than 1 billion barrels, but it certainly is well beyond what we are currently on track to getting in the reserve over the next few years.

Let me turn then to the question of drawdown policy which I think also is a problem which needs to be looked at in terms of the relationship between what the Government can do and what the private sector will do in response.

If I am correct that the principal benefit that we can look for in the strategic petroleum reserve is its ability to cut off the price spike by making more oil available in the market, then we are quite constrained in what kind of drawdown policies we would choose, and I distinguish between issues of managing the drawdown and issues of initiating the drawdown.

I believe that for us to manage the drawdown best, we should sell the oil at an open auction to any bidder who wants to purchase the oil, that this will inject the oil most expeditiously and directly into the distribution system and will maximize the impact that we have on the world oil price. Beyond that, I suspect there is nothing we can plan for. I am very concerned about the notion of triggers or committing to an early release or a late release of the strategic reserve.

I think that that decision can only be made in the context of the disruption that is taking place. Put crudely, if we expect things to get worse, we should hang on to the oil, and if we expect things to stay the same or get better, we should release early to ease the initial shock and the transition.

There is another issue about planning which has been raised which is the question that announcing a plan for using the reserve might have a deleterious impact on incentives in the private sector, incentives to store oil or make other preparations for a disruption.

I think that what kind of incentives will be created depends on what kind of a plan is put in place. If the plan is one which will allocate oil to favored individuals or industries at a price below the market, then there is certainly reason for concern because that will eliminate their incentives to undertake preparations.

On the other hand, an open auction I think would have only good consequences. It would set everyone on notice that oil will be available and, therefore, this may take away some of the frenzy and fear which has driven up prices and disordered markets in other supply disruptions, and it will also set everyone on notice if they can make preparations that are worthwhile at the market price during a disruption they had better do so because oil would not be available at any lower price.

Let me conclude my remarks there and answer questions.

[The prepared statement of Mr. Montgomery follows:]

PUBLIC INTEREST AND PRIVATE ROLES IN OIL STOCKPILING

Prepared Statement of

W. David Montgomery

Resources for the Future
1755 Massachusetts Avenue, N.W.
Washington, D.C. 20036

before the

United States Senate
Committee on Energy and Natural Resources
March 16, 1982

Mr. Chairman and Members of the Committee:

My name is David Montgomery. I am a Senior Fellow in the Center for Energy Policy Research at Resources for the Future. Resources for the Future is a nonprofit, tax-exempt research organization which, as an institution, takes no position on policy issues. I appear at your invitation and represent only myself. Prior to joining Resources for the Future I was with the U.S. Department of Energy , serving as Deputy Assistant Secretary in what was then the Office of Policy and Evaluation.

Over the past few years, a great deal of economic research has been done on oil import policy and on what could be done to reduce our economic vulnerability to oil supply disruptions. I think that the most useful contribution I can make today is to try to distill from that research some principles which can guide thinking about the Strategic Petroleum Reserve. In doing so I shall begin by addressing two related questions. First, what are the principle reasons for a public interest in maintaining large oil stockpiles? Second, for what reasons are private inventories of oil held and will those inventories be held at a level that comports well with the public interest? Essentially this will involve laying out a simple theory of the economic benefits, public and private, of oil stockpiles. Although nothing is ever certain, I believe it lends support to the idea that now is the time to buy oil. The theory also suggests some conclusions about how the strategic petroleum reserve should be used: whether there should be a plan, whether there should be some kind of triggers at which release is required, and whether it is wise to commit ahead of time to early or late release of the Reserve.

Costs and Benefits of Stockpiling: Public versus Private Calculus

Adding oil to the Strategic Petroleum Reserve involves a trade-off between costs incurred now, for certain, and benefits that might accrue at some future date in the event of a disruption. This trade-off suggests not that the strategic petroleum reserve is a questionable idea, but rather that there is some optimal size to the reserve or, more precisely, that there is an optimal rate at which we should acquire oil for the Reserve. It also suggests that since storing oil is never cost less, it is never worthwhile storing enough oil to entirely eliminate the price run-up in any possible disruption, but that it can be worth doing a good bit of storage to moderate the price run-up.

The cost of putting oil into the Strategic Petroleum Reserve has two components: the cost of the oil itself and cost of building and maintaining the facilities which will hold it. Putting oil in the reserve now makes it available for use during an oil supply disruption. The benefit of taking oil out of the Reserve can thus be measured as equal to the cost that would otherwise be incurred in obtaining the same amount of oil from a disrupted market. Private individuals can hold inventories as well as the government. The trade-off involved for both private owners and for the government is in its bare outlines the same, and requires comparing the costs of oil that is purchased and stored to the benefits that will be obtained when it is sold. Both in a sense can and should follow the rule of buying low and selling high. The difference is not in that rule but rather in what goes into the definition of the costs and benefits of oil imports. From a private perspective, the cost of oil put into inventories is simply its price, and the benefit of holding inventories is the potentially appreciated price at which the oil can be sold. Public authorities must take a broader view of the costs and benefits. I will argue that the price of oil underestimates the social cost of imports in normal and disrupted periods, but that the underestimation is more severe during a disruption than during a normal period. What is critical to the private decision about oil stockpiling is the difference between the price expected in a disruption and the price in a normal period. What is critical to the public interest is the difference between the social cost of oil in a disruption and the social cost of oil in a normal period. If a disruption causes social cost to increase by an amount larger than the disruption inspired increase in price, private inventories built to capture benefits of price appreciation will be insufficient to achieve maximum social benefits from stockpiling.

Let me illustrate this point first and then turn briefly to describe what I consider to be the principle reasons why there is a difference between the private and the social cost of oil imports and why that difference is increased by a disruption. Just to keep things simple, suppose we all know that the big oil supply disruption is in the offing.

The price of oil is going to rise from its current $30 per barrel in world oil markets to $45 per barrel six months from now. This will happen because of revolution or war or some other event which cuts off significant amounts of oil production from a major producing country or region. That difference of $15 from the current price to the price six months from now would cover interest charges and could indeed pay for some very exotic places to store oil. Thus we would expect a certain amount of private stockpiling if everyone believed in the scenario. As the stocks were built in private hands, the price of oil now would be bid up by the demand for larger inventories. At the same time the anticipated price and the actual price in a disruption would be likely to fall because there would be considerably more oil available to be released from stockpiles and to prevent the price of oil from climbing up so high in the event of a supply disruption. In the end, the size of private stockpiles would be determined by the point at which the price appreciaion gap, the difference between the current price and the expected future price, equaled the cost of storing one more barrel of oil.

If the difference between the current and expected social cost of oil is greater than the price appreciation gap, additional costs of storage could be tolerated and a larger stockpile would be desirable. This would imply that from a public point of view more oil is worth storing than we are likely to see stored by the private sector. Put another way, this argument states that while private agents never see all of the costs of imported oil, they see a larger fraction during a normal period than they do during a disrupted period. Therefore, although they will do something in stockpiling oil, buying it during normal periods in order to make it available during a disruption, they will not do much as the public interest requires.

The critical assumption in this argument is that the difference between the social cost of oil imports and the private cost is greater during a disruption than it is during a period of normal supply.

To examine social costs and benefits we must examine the ultimate origin and disposal of stockpiled oil.

When a barrel of oil is purchased for the Strategic Petroleum Reserve, oil imports will rise and oil consumption will fall. When that same barrel is released, oil imports will fall and domestic consumption will rise. How the SPR oil will be shared between imports and consumption depends on how the price of oil reacts to a change in net U.S. imports. If prices are independent of import levels, stockpile purchases and sales will translate barrel for barrel into changes in imports. If prices are very responsive to import levels, most of the oil stockpile purchase and sale will be absorbed by changes in domestic consumption. Thus the social cost of oil purchased for and sold from the reserve has two components: the social cost of changed oil imports, and the social cost of altered consumption. I will discuss these in turn.

One part of the social cost of imports is clearly the price of oil, which is recognized by private parties. However, much of the economic research that has been done on oil import policy, including the research in which I have been engaged for some time, implies that the price of oil does not accurately measure the cost of additional oil imports. Private agents pay one cost when they cause an addtional barrel of oil to be imported, but society bears another cost, which I believe to be higher. The difference between those two costs has been labelled an "oil import premium". I am sure that many of you have had this notion argued to you before, and I would like to touch on it only briefly. The principle reason that I would allege for any difference between the price and the social cost of oil imports is what has been called graphically a buying power wedge. When an individual increases his/her consumption of oil, he/she will save an amount of money equal to the price at which that oil sells on the market. But every increase in oil demand puts a slight upward pressure on the world price. To an individual this effect is so small as to be unnoticeable, yet a small increase in the price of oil when spread out across all the oil that is imported into the U.S. can add up to a number of some significance. This buying power wedge exists because a change in U.S. imports produces a change in the world price. In order to acquire additional supplies of oil from the market, it is necessary to bid up the price, either to bid the oil away from some other consumer, or to induce suppliers to supply a larger amount. The larger a price increase it takes to bring about a given increase in import supply to the U.S., the larger will be the size of the buying power wedge. This is equivalent to saying the more responsive the world oil price is to changes in U.S. import levels, the larger will be this buying power wedge between the private and social costs of oil imports.

Stockpiling policy depends on comparing the value of this wedge in normal markets to the value it would take on during a disruption. During a slack oil market, as we have today, the wedge might well be zero. The U.S. could probably increase its import demand a good bit without saving the oil exporting countries from the over supply of oil which now seems to be exerting downward pressure on price. During periods of tighter, but still nondisrupted markets, an increase of U.S. oil imports might serve to bring about some increase in the world oil price. Whether or not this is the case in the long run in normal markets is the subject of considerable argument. The simple story which I have told ignores many complications in the way OPEC countries behave. Without going into details here, let me mention that depending on how one assumes oil suppliers will react, we could find that a reduction of imports might lower the price of oil, it might increase the price of oil or it might leave it the same.

For thinking about stockpiling policies what is critical is to compare this possibly small value of the buying power wedge in a normal period to what it would be in an oil supply disruption. Let me lay out the scenario that I think underlies the most serious concern about oil and security. Revolution or war or conscious political act causes one or more countries to cease oil production. This means that at the prevailing price much less oil is available for sale. Other oil producers might be willing to take up the slack but additional output will normally require significantly higher prices. Consequently, the world price of oil will rise rapidly, holding only at a level which reduces demand sufficiently to clear the market. During the compressed time scale of an oil supply disruption, a considerably higher price would be needed to bring about increased output compared to the price increase that could induce such output over the longer time scale that might operate in normal markets. That is, during the short time period of a disruption, we can expect supply to be much less responsive to the world price of oil than it is over the long term in normal markets.

As a result, a given reduction import demand during a supply disruption will have a much greater effect on the world price than would the same reduction in import demand during a normal market period. Consequently, by the argument outlined above, the buying power wedge would be greater during a disruption than during a normal period. The immediate consequence of this observation is what I argued earlier. Private agents will not accumulate inventories as large as those that are warranted by the social costs of oil imports in a normal and disruptive periods.

Purchases and sales of oil by the Strategic Petroleum Reserve will, as I noted earlier, affect domestic consumption as well as imports. These changes in consumption also have a social value, in addition to the price individuals pay for oil, because of the macroeconomic costs of oil price jump. Reducing oil consumption in normal periods tends to reduce the macroeonomic costs of an oil price shock, while increasing consumption durng a disruption tends to do the same. As a result there is a social value to stockpiling that derives from its effect on oil consumption, as well as one that derives from its effect on oil imports. To a rough approximation, this value can be incorporated by treating the social cost of the entire stockpile purchase or drawdown as equal to the social cost of oil imports.

Let me expand on this idea of macroeconomic costs that can be avoided with stockpiles. An important category of macroeconomic costs of a supply disruption derive from the resulting shock to domestic price levels. This shock leads to reduction in demand for oil and energy intensive goods, and to a rearrangement in all consumption decisions as people find more of their income going, directly and indirectly, to pay for oil. Inflexible wages and prices interfere with the ability of the economy to respond to this desired rearrangement of production, leading to unemployment in some sectors and shortages in others. These imbalances result in a loss of economic output and welfare additional to the added cost of oil imports. Because they stem from supply side rigidities, these losses cannot be eliminated by the aggregate demand management possible with monetary and fiscal policy. Their magnitude can, however, be reduced by reducing the significance of energy to the economy--that is, by reducing oil consumption in normal periods. The required adjustments to a disruption can also be reduced by reducing the swings in oil consumption that would result from private reactions to market price. Oil stockpiling works through the market to have precisely these effects. Thus the macroeconomic costs of a disruption provide an additional reason for a public interest in stockpiling. In essence, oil stockpiles make it possible for us to disconnect consumption from imports. They make it possible to reduce imports substantially, achieving social benefits from a lower world oil price, without bearing the macroeconomic cost of large swings in consumption.

Let me sum up this section of my testimony. The simple economic model that I have proposed suggests that there is a public interest in having stockpiles larger than those that would be accumulated by private agents. Private agents will accumulate stockpiles, but insufficiently. I would suggest that the lack of realism in this model all goes in the direction of overestimating what private agents will do. Two features of the market make me believe that private agents may well do even less stockpiling than this simple theory would predict. I do not believe that concerns about the prospect of reimposition of government price and allocation controls during a disruption have been completely allayed. If such price and allocation controls are imposed, oil held in inventories will not have a value to its owner equal to the world price. Its value will equal either the controlled price or whatever the owner can realize from oil allocated to some particular use. Thus the spectre of price and allocation controls dilutes the incentive to hold inventories in the anticipation of price hikes. Second, investing in such inventories is clearly a risky prosposition. The bulk of inventories which we see in the U.S. are held for what we may call transaction pusposes, to keep the pipelines full and to smooth out the availability of oil between deliveries and between shipments. Inventories held in addition to the transaction demand for inventories we may call speculative demand for oil. Speculative demand is based on an expectation that the price of oil available in the market will be much higher on some future date. To some extent this investment provides insurance, or, more properly hedging. But for many it could be an extremely risky investment, because long term prospects for oil appreciation in stable markets cannot justify the holding of inventories now. It is only disruption risk that makes inventory holding for speculative purposes profitable. I find it difficult to convince myself that investors would be willing to take that risk on a large scale, because the risk involved is quite different from ordinary business risks. It is really betting on the extremes of oil prices.

Implementing the Public Interest in Stockpiles

If then, a larger level of stockpiles than would be held voluntarily in the private sector is desirable, how can it be obtained? There are three broad options; first, the government can buy and store oil itself; second, the government can create incentives through imposing a variable tariff; or third, the government can provide some form of direct incentives tied to the amount of oil individual sput into storage. Let me look briefly at the pros and cons of each of these, in terms of the theory that I have outlined already.

Buying oil for the Strategic Petroleum Reserve has the positive virtue of being simple, direct and, if the money is available, quick. Its major drawbacks are two. First, purchases of oil require money from the Federal budget, and second, purchases of oil by the government will tend to drive out private stocks. Government purchases will reduce private inventories little when government reserves are small, but as the government reserve gets larger and larger, expected swings in price will become smaller and smaller. The swing in price is what makes the private sector willing to hold stocks. As the expected swing becomes smaller because of the availability of government reserves, the private sector will sell off its reserves to the government. Thus for some period of time the government might simply be in the process of buying oil out of private stocks and putting it into its own. Nevertheless, by the time we reached an optimal size of the public stockpile, total stockpiles would be increased by government purchases.

The second option would be one of imposing a disruption tariff, equal to the buying power wedge of the import premium that I mentioned. This action would involve a very large tariff during a disruption and a relatively small tariff during normal periods, and a guarantee that there would be not price controls or other confiscation of speculative gains. The virtue of this approach would be that the private sector itself would form a decision about how much oil was worth stockpiling. In principle, private parties would stockpile precisely the amount that is in the public interest, and there would be no transfer of existing stocks to the government. The drawback of this proposal is a very big one. A large enough tariff to bring about the optimal stockpile would be very much too large in light of the macroeconomic costs it would impose. With a tariff oil purchased for consumption would face the smae high price as would oil sold out of the stockpile and the domestic price shock would be exaggerated.

Third, we could make direct incentives, such as tax credits or subsidized storage available to each barrel of oil that was added to storage. The virtue of this approach strikes me as being its ability to exploit private storage opportunities. Providing an incentive would not lead anyone to sell off their current speculative holdings in the way that purchasing oil for the government's stockpile would, and consequently these incentives might be cheaper in the short run than direct government purchase of oil. However, such an approach could involve considerable problems in determining what constituted a stockpile held for speculative reasons, and might provide large windfalls to people who would have stored the oil anyway. Finally, given the still risky character of investment in inventories, its not at all clear that the incentives would work.

Looking at these pros and cons I am inclined toward the idea of buying oil for the reserve. I suspect that a workable system of direct incentives could be devised, but devising and implementing such a system to induce further private storage would not to be a quick process. If now is a particularly good time to acquire oil reserves, for the time being government purchase may be the only way to go.

Should We Buy Oil Now?

That leads me to the final question that I want to address in this part of my testimony: whether now is the time to be acquiring additional oil for the Strategic Petroleum Reserve. One way of formulating this question is to ask whether the current size of the Strategic Petroleum Reserve is already large enough. I have not done any research of my own on this question, because I thought I could add little to existing studies. Studies that I have read over the past few years all estimated the optimal size of the Reserve at one billion barrels of oil or more, depending on how pessimistic the author is about the threat of supply disruptions. My reaction to these studies was that they all pointed to a size and a rate of acquisition so much larger than I ever expected to see that I did not think there was much to contribute by further attempts to refine those numbers. I continue to believe that even if we take into account some revision of their assumptions--lower levels of oil imports, some excess production capacity, and somewhat lower production from the particularly vulnerable regions of the Persian Gulf--it is very unlikely that the optimal size of the Strategic Petroleum Reserve equals its current level.

Aside from these general observations, I think the simple theory that I have sketched out suggests several conclusions about buying oil now. First, oil now is relatively a bargain, compared to what it was a few years ago and to what it is likely to be in the long term. That, however, is an ambiguous point, because if we expect the price of oil to fall further, we might save some money by waiting a bit to purchase oil. But if the prospect of a supply disruption continues, there is a continuing prospect of a sudden jump in price. Moreover, costs of large changes in the rate of filling the Reserve imply that attention must be paid to what market conditions will be in 1985 and beyond, not merely in the next year or two. I believe that the prospect of disruption and the long term prospect of price increase outweighs in importance any prospect of small drops in price over the next year or two. If we were to delay purchase of oil for three years, and then try to make it all up in one year, we could increase the costs of acquiring oil substantially. Pressure on oil price at that time could be much greater than it would be if oil purchases were spread out. In addition, excess production capacity now in workable condition might well erode if nothing is done to stabilize oil demand. Thus oil market risks now in abeyance could return in a few years.

There are more extreme forecasts of a major permanent fall in price, that do argue against any further acquisition of oil stockpiles. These point out the inherent choice involved in stockpile policy: of whether to take the risk of purchasing oil now and seeing its capital value erode, or the risk of not buying oil and regretting it in the event of a sudden rise in price.

Those who believe in a prompt end to the oil problem, averring that exports from insecure regions will be negligible, that large excess capacity will exist in secure regions, and that imports will become negligible in the next few years, have produced an argument that only supports termination of the reserve, not delay in the purchase of oil. If the maintenance of an Strategic Petroleum Reserve remains a goal of policy, I would argue that temporary lulls in the market are times to buy aggressively because both the private and social costs of acquiring oil at such points In time are quite low. Government purchases of oil under current conditions may not drive up the price and may not drive out private purchases of oil to the extent that they would at other times. Moreover, the prospect of scrambling to acquire oil in a possibly tighter market in the future would be avoided.

Drawdown Plans and Strategies

Let me turn now to the subject of using the Strategic Petroleum Reserve. The simple theory that I have sketched out indicates one principle reason for having the SPR: that is, to moderate the run-up in world oil prices during a supply disruption. If the Reserve has that purpose, then the ways in which it should be drawn down are quite constrained. If the principle purpose of the Strategic Petroleum Reserve is to moderate the run-up in world oil prices, the important management problem is to inject oil from the reserve into the system as expeditiously as possible. Attempts to direct the oil to specific users, especially at a price below the market level, will only be counterproductive. They will be counter-productive during the disruption because they will serve to increase oil consumption by consumers who have demonstrated an unwillingness to pay the market price for oil, and will make the oil unavailable to the market as a whole where it could serve to hold down the price. They will counterproductive before the disruption by diluting incentives to make private preparations. I believe the simplest and most direct way of injecting oil into the market would be through competitive auction, open to any bidder and held on the Gulf Coast. That will inject oil directly and quickly into the system, and the standard logistics of transport and exchange can get the oil to where it is demanded. Naturally, the greater is the quantity offered, the lower will the price of oil be driven. Critical decisions remain therefore about how much oil to offer and when to offer oil for sale.

I would argue that these decisions cannot be made in advance of a disruption. They can only be made on the basis of expectations about how a disruption will unfold. At the crudest level, a judgment must be made about whether things will get better or worse. If an oil supply disruption were to occur because of an isolated event and were judged unlikely to expand, then early release would make sense. How much to release would depend on how large the idsruption was. If, on the other hand, a fundamentalist revolution were to begin in a Persian Gulf country, and if intelligence reports indicated it were likely to succeed and spread to other countries, oil in the reserve could become increasingly valuable over time and late release would do the most good.

A more refined analysis would examine the likely course of world oil markets more closely. One benefit of selling oil from the reserve is measured by the price of oil. The greatest benefits would accrue from selling at the highest price, taking into account the effect the sales themselves have on price. Unless the disruptiom is extremely severe, it can make sense to hold back some oil because of the continuing risk of a later, worse situation. These comparative risks need to be gauged and a decision amde as to how much of the reserve to draw down in the particular disruption at hand. The time profile of a drawdown then needs to be determined. Good business sense suggests selling before the price falls. If the entire reserve is sold off very late, the sale itself can cause a significant earlier fall in price. This suggests selling less at the end and more early on. Following this line of reasoning to its conclusion suggests spreading the draw out over the course of the disruption, tilting toward the beginning if things are expected to improve and toward the end if they are expected to get worse.

I would argue that there is some presumption that things will get better as a disruptiuon proceeds, simply because time will elapse. Suppose for example that the disruption were a permanent destruction of a significant portion of the world's oil production capacity. Then it would be very important to release the strategic reserve early on because over time the world can adjust. Long run demand elasticities are larger than short run, and long run supply responses are likely to be greater than short run, so that over the course of years the world can work its way out of the immense initial cost of the disruption. The reserve should be used to ease that transition.

The compensating argument is that the risk of greatest concern is one of a military conflagration in the Persian Gulf region and that the reserve, or at least some portion of it, must be held on to long enough to ensure that we continue to supply vital defense needs in a long battle.

Taking these factors into account, I believe that the way in which oil would be distributed in an emergency can and should be announced, and that the method should be auction. Second, I believe that mechanical triggers should not be set. What matters is how the future will unfold. Triggers are fundamentally based on what has happened in the past. Any trigger that can be imagined may mandate release even though the best intelligence available to the President indicates that the oil will be much more valuable in the future or may prevent release even when a quick and surgical use of the reserve would be valuable. I would argue that there is no substitute for good intelligence, in the specific sense of information about how the world political and economic situation is likely to evolve.

One important factor which must also be taken into account in talking about a plan for using the reserve is the effect that anticipations of the use of the reserve will have on prior actions in the private sector. Concern has rightly been expressed that announcing a plan for using the strategic reserve will change the incentives that private individuals have to prepare themselves, through conservation and stockpiling, for a disruption. That is true. But I would suggest that any plan which needs to be kept secret because of its perverse effect on incentives probably is a plan that should not be adopted anyway. If the plan is to allocate oil below its market price,then keeping that plan secret may make sense. Such a plan will certainly reduce the incentive of those favored in it to take any preparatory action.

I also suggest that it likely would not help to try to keep the plan secret. First, I can testify that it is very hard to keep anything the Department of Energy does secret. And second, even succeeding in keeping the plan secret would mean that everyone would hope for special treatment, rather than some knowing that they would get special treatment and others knowing that they would not.

But if the plan were to sell oil at a competitive auction, then I believe all the effects on private incentives would be good. It would be known that oil would be injected in the market and would be available to anyone who found it impossible to get oil from other sources. This could well prevent the panic which many fear at the beginning of a disruption. More importantly, the plan would set everyone on notice that oil would be available at no less than the market price; and that anyone who can find ways of accumulating stockpiles or making other preparations for a disruption that are worthwhile given the market price in a disruption had better do so. It is true that if we had no Strategic Petroleum Reserve, private individuals would make even greater preparations because they would anticipate an even higher price. But I see no prospect of tricking them into doing so by trying to keep secret what will be done with the reserve and whether it will be used. I think that only serves to increase uncertainty, forcing private individuals to face not only uncertainty about how the world oil market will work but also uncertainty about what the government will do in response. That uncertainty must impose a cost on our market economy.

It is with a thought relating to the use of the reserve and planning for the use of the reserve that I would like to sum up. I began by discussing the public interest in building a Strategic Petroleum Reserve, and moved into a discussion of how the reserve would be used as well as how it would be built. I then discussed in more detail some ideas about planning for the use of the reserve and how those plans could affect private incentives for making preparations for an oil supply disruption. That thought can be extended.

There are ways of using the Strategic Petroleum Reserve that would have so little value that if they were to be adopted, the nation might be better off not investing any money in building a reserve. A reserve that is never used is one that it is not worth spending the money to build, unless its very existencw can deter politically motivated acts directed at the oil importing countries. A reserve that is used to perpetuate market distortions during an oil supply disruption through direct allocation to favored individuals may also be worth less than the cost of building the reserve. But I believe that a reserve which is managed wisely to supplement the response of the market economy, and to capture for the public those benefits of downward pressure on world oil prices that no private individual can capture alone, will clearly be an asset to the nation.

Senator WARNER. I will turn to my colleague Mr. Matsunaga here.

Senator MATSUNAGA. Thank you, Mr. Chairman. Do you feel that setting up reserves in the private sector ought to be made compulsory?

Mr. MONTGOMERY. No, sir, I don't.

Senator MATSUNAGA. Now do you feel that the SPR oil should be used to control the cost of oil, that is, release when the price is high and increase the reserves when the price is low?

Mr. MONTGOMERY. Yes.

Senator MATSUNAGA. You do?

Mr. MONTGOMERY. Yes.

Senator MATSUNAGA. Of course, that would cut down the incentive in the private sector, would it not?

Mr. MONTGOMERY. Yes, it would, but I don't think that that is harmful. One can do too much in preparing for a disruption as well as too little, and by foregoing the use of the strategic reserve and inducing private industry to make even more intensive preparations, we may incur costs now that is not worth the benefits in the future.

I would put a qualification on that, though, because stockpiling, as Mr. Peach mentioned, is only part of a total emergency response capacity, and it may well be, and the argument that I made that there is a difference between the social cost of imports and the private cost during a disruption suggests that it may well be useful to take other measures which will induce additional private preparations and help to moderate demands during a disruption.

Senator MATSUNAGA. Will you briefly describe social cost as distinguished from private cost?

Mr. MONTGOMERY. I will try to be brief, though I know I have a hard time being brief on this subject. Let's look simply at the import bill, though there are other components to the social cost. An individual pays a certain amount for oil, say the amount that I pay during the year for gasoline for my car.

When I decide to increase my purchases of gasoline by a gallon, what I increase my bill by is just a $1.20 or so. On the other hand, that increase in my purchases produces a little bit of pressure on the world oil price so that the total import bill for the Nation goes up by not just the $1.40 which I have spent for an additional gallon of gasoline. The price goes up for everything that we are purchasing, and that little increase in price multiplied by the total quantity of imports is the difference between social cost and private cost that I am focusing on.

Senator WARNER. Will the Senator yield for a question? You brought up a very important point. What sort of incentive would you give the private sector for storage tanks? Wouldn't we be subject to indictment that we are throwing it away to big oil?

Mr. MONTGOMERY. Yes, I'm afraid so, and that is one of the reasons why I tend to keep coming back to the notion that it is hard to think of a workable system other than the Government purchasing the oil. I think one could be put together, but it clearly would be one where the charge was always open that we were paying people either to, we were either giving money to big oil, or we were giving people who were making exorbitant profits during a disruption even more profits through additional incentives.

Senator WARNER. Do you have anymore questions?

Senator MATSUNAGA. No.

Senator WARNER. We thank you very much, Mr. Montgomery. We will now turn to our very patient next and last witness, Dr. Holcombe. We thank you for your indulgence.

Dr. HOLCOMBE. Thank you, Mr. Chairman. It is a pleasure for me to be here.

Senator WARNER. We will put your statement in its entirety in the record if you would care to highlight.

Dr. HOLCOMBE. Thank you. I will summarize what I have to say then on my statement.

STATEMENT OF DR. RANDALL G. HOLCOMBE, ASSISTANT PROFESSOR OF ECONOMICS, AUBURN UNIVERSITY

Dr. HOLCOMBE. First of all, the position that I take is an unpopular position both with members of the committee and also with regard to previous testimony.

I think we should not have a strategic petroleum reserve, the reason being that the costs of the reserve exceed the benefits that we could expect to receive.

Senator WARNER. Would you be kind enough to take that mike and bring it a little closer? We are anxious to hear your views.

Dr. HOLCOMBE. Yes, sir.

Senator MATSUNAGA. I may agree with you.

Dr. HOLCOMBE. After I talk about that briefly, I will talk about an alternate proposal that I have, talk about some of the effect that we could expect during a disruption, and I also have some remarks about drawdown strategy.

When the strategic petroleum reserve was originally conceived, it was conceived as a short-term solution to a short-term problem. It was a response to the OPEC oil embargo in the winter of 1973 and 1974, and the idea was if we had another embargo, we would have this strategic petroleum reserve ready to use.

It is not a solution to a long-term problem because if we did have a permanent disruption in oil imports, if something happened so that we permanently were unable to receive oil imports, the strategic petroleum reserve would be woefully inadequate. When the reserve was proposed, the Federal Energy Administration undertook a study which was published in 1976 in which they did a cost/benefit analysis to try to weigh the costs and benefits and to determine the optimal size of the reserve. Their report in 1976 showed the optimal size of the strategic petroleum reserve to be 500 million barrels.

Since that time, a lot of things have changed. The original report estimated the construction and acquisition costs of land for the strategic petroleum reserve to be between $1.38 and $1.65 per barrel. That cost has escalated tremendously, and the original cost/benefit analysis also estimated the cost of oil to fill the reserve to be $13 per barrel.

In using those cost estimates, the 500-million-barrel reserve then was estimated to cost between $7.5 and $8 billion. Since that time, nothing has happened to appreciably alter the benefits that we could expect to receive from the strategic petroleum reserve, but the costs have escalated tremendously, and so now if we wanted to construct a 500-million-barrel reserve, the cost would be about $18 billion in total.

If we decide that a 750-million-barrel reserve is more to our liking, that is going to end up costing $27 billion, and a 1-billion-barrel reserve would cost in the neighborhood of $36 billion.

Now I don't want to minimize the energy situation that our country is in. We certainly have an energy problem. We certainly want to deal with it in some way. What I argue is that we would be a lot wiser to invest that money in productive capacity in the domestic energy industry than to literally pour it into a hole in the ground. We are not increasing our productive capacity. We are making no permanent addition to our energy industry. All we are doing is buying a temporary solution to what we hope will be a temporary problem. When the oil in the strategic petroleum reserve runs out, we will be in bad shape.

The original Government's cost/benefit analysis showed 500 million barrels to be the optimal size, and I know of no reason to fault that cost/benefit analysis on the positive side right now so that I think the events that have happened since the original cost/benefit analysis in 1976 only lean toward the argument that the reserve ought to be smaller than 500 million barrels. In fact, I would say we have an adequate reserve as it is.

I think it is important, though—let me mention also that currently at an interest rate of 14 percent which is what the Treasury is currently paying and that is what we are paying for the strategic petroleum reserve oil, the oil that is stored right now, if we had invested that instead in Government securities, could be earning over $1 billion a year in interest. That is just the oil that is in there now, and that $1 billion could go a long way toward providing some domestic alternate energy capacity rather than just pouring oil down the ground.

The energy problem that we face in this country is the problem of having too much in oil imports. I think the whole Department of Energy budget is focused around reducing the level of oil imports because we don't want to be dependent upon potentially unpredictable foreign supplies of oil, and I think the best solution that we could have in that case would be to put a tax on the behavior that we want to discourage, namely, imported oil, so I would propose as an alternate solution that we have an oil import tax placed directly on imported oil and just for purposes of illustration, I have suggested a tax that begins at $2 per barrel and increases by $1 per barrel every year thereafter. That way the tax would be phased in gradually. A tax on oil imports directly taxes the behavior that we want to discourage, and so that would directly provide people with incentive not to import oil which is after all the concern that the strategic petroleum reserve focuses on.

At the same time, if we put a tax on imported oil and we guarantee that tax was not only going to stay in place but was going to escalate, domestic producers would know that that would provide a lot of security for domestic energy industries. Right now people are very reluctant to get into, for example, synthetic fuels because it appears to be marginally cost effective at some of the oil prices that have been forecast in the future, but the energy situation that we see right now, the world oil situation today shows that in the event of a glut, the world oil price can fall a great deal very rapidly. As a result, few firms are willing to get involved in taking a long-term commitment to produce alternate energy sources because they know that ... order to sell that, they are depending upon a relatively high price of oil, and we can provide some protection to those domestic industries by having an oil import tax as well, so to summarize about concerning the oil import tax, it would discourage imports which is a goal that would further our energy security. It would encourage domestic production of energy, and would further have the beneficial effect of raising revenue for the Government which is a concern today, and would also help out our balance-of-payment situation.

Let me make a couple more remarks which might be looked at as footnotes to the testimony I have just given. One thing we need to look at is how an oil embargo would harm the Nation. How would that harm the Nation? We can look at the last oil embargo in 1973 and 1974 and there were two types of effects that caused that oil embargo to harm the Nation.

The first obvious effect is that we have less oil available. As a result of having less oil available, industries don't have as much oil to use. Consumers don't have as much gasoline to put in their cars. They can't drive the way they used to, and as a result of those reduced supplies, the economy is less productive. I call those supply-induced impacts.

An important aspect of the effect on the economy from an oil embargo also is the fact that there are what I have called demand-induced impacts. During the last embargo, for instance, in 1973 and 1974, the automobile industry was very severely harmed. The reason was not because they couldn't get enough oil to produce automobiles. It was because consumers didn't want to buy automobiles in that uncertain situation, and so if we have a strategic petroleum reserve in place and we could replace all of the lost oil, we still wouldn't overcome these demand-induced impacts, and I have estimated that the demand-induced impact would run anywhere from one-third to one-half of the total economic cost of the embargo, so that having a strategic petroleum reserve does not guarantee that there will not be economic disruption and certain industries, particularly the automobile industry, and other industries that are related to travel, are not going to be severly harmed as well, so we really are overstating the value of the strategic petroleum reserve if we think it is going to help us completely mitigate the effects of an oil embargo should we have one.

The last thing I wanted to talk about was optimal drawdown strategy. I just want to say a few words about that. I would be in favor of an auction-type system, and I think we should in the event that we use the strategic petroleum reserve, draw down the reserve as rapidly as possible in order to lessen the impact on the economy. This is especially true if the duration of the oil import interruption is uncertain because the oil that we draw down early on in an import disruption is oil we are sure to use. The oil that we save for later we may or may not use because we don't know how long the disruption is going to last.

If we plan, for example, for a 6-month drawdown, and the embargo lasts for 3 months, we have not used half of the oil, and we have given up part of the opportunity to benefit from the strategic petroleum reserve.

That concludes what I have to say.

[The prepared statement of Dr. Holcombe follows:]

Statement of Dr. Randall G. Holcombe
Associate Professor of Economics
Auburn University

before the
Subcommittee on Energy and Mineral Resources
U.S. Senate

THE COSTS AND BENEFITS OF THE STRATEGIC PETROLEUM RESERVE

Mr. Chairman, and Members of the Committee:

The OPEC oil embargo in 1973 and 1974 forcefully illustrated that the United States is vulnerable to interruptions in oil imports, and the nation wisely embarked upon programs to limit the extent of this vulnerability in the future. Through a combination of public sector and private sector efforts, our level of oil imports is now declining. Shortly after the OPEC embargo, a Strategic Petroleum Reserve (SPR) was proposed, and the Federal Energy Administration undertook a study designed to assess the feasibility of an SPR, the optimal type of storage, and the optimal size of the reserve. After more than a year of study, the Federal Energy Administration published their results as the Strategic Petroleum Reserve Plan (Public Law 94-163, Section 154), December 15, 1976.

The finding of the cost-benefit analysis in 1976 was that the optimal size of the SPR would be 500 million barrels, and that the 500 million barrel reserve could be in place by 1982 at a cost of between $7.5 and $8.0 billion (p. 15). Construction and land acquisition was estimated to cost between $1.38 and $.165 per barrel (p. 15), and the oil was estimated to cost $13 per barrel. These costs total $7.325 for a 500 million barrel reserve, leaving the remainder for overhead and administration. When this plan was released less than five and a half years ago, it was well received, and both President Carter and President Reagan have strongly endorsed the strategic petroleum reserve.

Since the conclusion of the original cost-benefit analysis, a number of things have happened that affect the conclusion that a 500 million barrel reserve is optimal. For one thing, the estimated costs of construction have more than tripled since the original cost estimates, and the actual price of oil has risen to over $30 per barrel rather than the $13 per barrel that the cost-benefit analysis used. Assuming that the cost of oil for the reserve is $32 per barrel (less than we have been paying) and that the other associated costs are $4 per barrel (again, this is likely to be a conservative estimate), the cost of a 500 million barrel reserve will cost $18 billion, rather than the $7.5 billion to $8 billion originally estimated. If the SPR were increased to 750 million barrels, the cost would be $27 billion, and a one billion barrel reserve, which some in DOE have argued for, would cost $36 billion.

The original cost-benefit analysis found the SPR to be only marginally cost effective under the assumption that a 500 million barrel reserve would cost under $8 billion. Since then, both oil and construction cost estimates have soared, and using the government's own cost-benefit model, the SPR would no longer be cost effective. Furthermore, my own opinion, supported by my published research on the subject, is that the benefits of the SPR were overestimated in the first place. Clearly, using the criteria under which the SPR was originally established, it is no longer cost effective.

To get some idea about the magnitude of the costs, consider the foregone interest cost alone for storing oil that costs $32 per barrel. 500 million barrels at that price would be worth $16 billion, 750 million barrels would be worth $24 billion, and one billion barrels would be worth $32 billion. At a conservative 10 percent rate of interest, the interest cost alone on the stored oil would be $1.6 billion per year for a 500 million barrel reserve, $2.4 billion for a 750 million barrel reserve, and $3.2 billion for a one billion barrel reserve. This is the amount of money that could be saved every year by not having the reserve. And I want to emphasize that these figures are the interest cost of the oil alone, and do not include the acquisition, construction, storage, overhead, or administrative costs. The strategic petroleum reserve is a very expensive form of insurance.

Today, the SPR contains approximately 225 million barrels which, if valued at $32 per barrel, is worth $7.2 billion. The interest rate on five year securities issued by the Treasury is about 14 percent, so today's interest cost on the oil already stored is in excess of $1 billion per year. Again, this does not include acquisition, construction, storage, overhead, or maintenance costs. It only includes, in effect, the interest that could be earned on that money if it were invested in financial assets instead of oil that is buried underground. At current interest rates the proposed tripling of the size of the reserve would push the interest cost alone to over $3 billion. One must seriously ask if the nation's energy interests would not be better served if these billions of dollars were invested in productive capacity to increase domestic sources of energy, or into research on alternate energy sources. My opinion is that the nation's energy security would be better served by investing these billions of dollars into the production of domestic energy rather than buying OPEC oil and literally pouring it back into the ground. The SPR hurts our balance of payments, increases the Federal budget deficit; it is a drain on the nation's productive capacity, and the government's own cost-benefit analysis shows that with its increased cost, it is not cost-effective.

As a result of the increase in the cost of the SPR, the justification that its supporters use is no longer economic, but political and military. The International Energy Agreement specifies that we stockpile oil, but the present reserve is large enough that we should examine other alternatives before increasing the size of the reserve further. The present reserve is more than adequate for political purposes.

Stockpiling oil in the SPR for military purposes is not justifiable if examined closely. Under plausible scenarios, the military services would not experience an oil shortage without the SPR. Of course, a situation can always be imagined in which the SPR could have military importance, but the same could be said for additional military manpower and hardware. If the SPR really is being constructed because of its military value, then I recommend that it be placed in the Defense Department budget, and that the Department of Defense be allowed to use the SPR money for other purposes if they believe that our military preparedness could be better served by spending those billions of dollars on manpower and hardware. Regarding its military role, the SPR is a very expensive weapon.

Cost grounds aside, the main reason that the SPR should be abandoned is that it does not provide an adequate response to the type of energy crisis that we are likely to have in the 1980's and beyond. Admittedly, there are scenarios in which the SPR would be beneficial, but those situations are unlikely, and the SPR would not be absolutely necessary even then. The SPR was designed as an answer to the oil embargo that we had in the Winter of 1973-74, and had we had the SPR at that time, we would have been better off, even though we were able to survive without it. But the SPR was designed for the last crisis, not the next one. In the event of an all-out war in the Middle East, for example, the SPR would be woefully inadequate if oil imports were interrupted for a prolonged period of time. We are buying ourselves a false sense of security, and an expensive one at that.

If our oil imports were temporarily interrupted for a period of a few months, as they were during the OPEC embargo or the Iranian revolution, the SPR could provide a welcome interim source of oil; but those instances have shown us twice that we could get along without an SPR. If we are to spend billions of dollars on a plan for energy security, we would be much better off using the money to permanently develop our domestic energy industry rather than to buy an expensive form of insurance that could provide temporary protection at best in another energy crisis. As a result, I recommend that no further funding be given to the Strategic Petroluem Reserve.

An Oil Import Tax as an Alternative

If a unifying principle can be found behind the nation's energy budget, it is to reduce oil imports so that the nation will not be vulnerable to the whims of unpredictable suppliers. Obviously, the idea behind the SPR is to shelter the nation from some of the harm that could come from an interruption in oil imports. This goal can be best furthered by an oil import tax, the details of which I have explained eslewhere.[1]

The basic principle behind an oil import tax is that putting a tax on an activity discourages the activity. A tax placed directly on oil imports would make it more costly to import oil and so would discourage imports. The lower level of energy imports would directly further the goal of energy security, and would have other indirect benefits as well. Insuring a higher price of imported oil would provide a degree of market security to domestic energy firms, and particularly to those who are engaged in producing alternate energy sources. The synthetic fuels industry is in its infancy in this country, and the reluctance to enter the industry can be better understood when it is recognized that synthetic fuels are expensive to produce, and that world exporters can cut prices to maintain their market shares. A tax on oil imports can provide some protection to domestic producers and so will aid in increasing domestic production as imports fall.

As a suggestive outline of how the tax might be implemented, a tax of $2 per barrel could be enacted this year, with the tax schedule to increase by $1 per barrel every year from now on. This way, the tax would be phased in, and could increase every year which would discourage imports and encourage domestic production. Such a tax would raise revenue for the government at the same time. By replacing the SPR with an oil import tax, the government could raise billions of dollars in revenue every year instead of spending billions of dollars, oil imports would be reduced, and domestic production would increase. If reducing oil imports is our energy policy goal, then an oil import tax is the perfect solution, and it is especially appropriate at a time when the size of the budget deficit is an important concern.

How do Oil Embargoes Harm the Nation?

Much of my research in the energy area has been devoted to studying how an interruption in oil imports affects the economy, and I want to mention an important finding of mine that is significant to the calculation of the benefits from the SPR, and which, as far as I know has been ignored.[2] The obvious consequence is that with a reduced oil supply, people must reduce their driving, manufacturers must reduce their use of energy, and thus their output, and as a result the economy cannot produce as much. I have called effects like these supply induced impacts. Another important aspect of the economic harm that results from an oil import interruption is that consumers reduce their demands for some goods and services as a result of the interruption. The automobile industry provides a particularly good example. During the 1973-74 embargo people postponed their purchases of automobiles because of the energy uncertainty, and this reduction in demand would have occurred whether or not we had an SPR at the time. Other travel-related industries would suffer the same effects. These effects I call demand-induced impacts, and they would exist whether or not we have an SPR.

The conclusion is that even if an SPR were available to replace all of the lost oil during an interruption in oil imports, the economy would still suffer the effects of the demand-induced impacts as people postpone some purchases and change their buying patterns in other ways. My estimates show that for plausible oil embargo levels the demand-induced impacts compose between one-third and one-half of the total economic loss of the embargo. This means that even if the SPR could replace all of the lost oil during an interruption, there would still be significant economic losses. This is one reason why I feel that the benefits of the SPR have been overstated.

The Optimal Drawdown Strategy

In the event that the SPR is completed or that we have occasion to use the oil already stored, the value of the SPR is crucially dependent upon the drawdown strategy used. For this reason, I will close my comments with a brief note on the optimal drawdown strategy. If the length of an oil import interruption were known beforehand, the optimal strategy would be to use an equal percentage of the SPR each day. For example, for a 200 day interruption, 1/200th of the SPR should be used each day. It is highly unlikely that we would know the length of the interruption beforehand, however.

In this case, the benefits of the oil in the SPR depend on the probability that the oil is used, and with an uncertain interruption length, the probability that the oil is used declines the longer the oil is kept. For example, assume that an oil embargo occurs and a drawdown strategy is adopted that would empty the SPR in six months. The probability of using the oil scheduled for removal in one week is greater than the probability of using the oil scheduled for removal in five months since the probability of an embargo lasting at least a week is greater than the probability of an embargo lasting at least five months. Thus, the longer into the embargo the oil is planned to be held, the lower is the probability that it will be used. In order to maximize the value of the SPR, the oil should therefore be drawn down as rapidly as possible to replace the embargoed oil. The only limit on the rate of drawdown should be that the SPR oil should not cause the price of oil to fall.

The intuitive logic behind the optimality of a rapid drawdown to replace all of the lost oil is the following. If the drawdown rate is such that all of the SPR would be used in six months, but the interruption only lasts three months, then half of the SPR would not be used. A barrel of oil produces benefits only if it is used, so the drawdown rate should be as rapid as possible to maximize the probability of using the oil in the SPR. While I have explained the logic of the argument here, this conclusion can be derived more rigorously in a mathematical model.

Summary

1. The costs of building the SPR are much larger than originally estimated. Using the cost-benefit analysis that was originally developed to justify the SPR but using the updated cost figures, the SPR is shown not to be cost effective.

2. The SPR is an expensive form of insurance designed to protect against the last energy crisis, not the next one. Energy security would be better served by spending these billions of dollars every year on the development of domestic energy supplies.

3. An oil import tax is preferable as a substitute for the SPR. The tax could lower oil imports, increase domestic energy production, help the balance of payments, and reduce the Federal budget deficit.

4. In the event of an interruption in oil imports, the SPR could not prevent all of the economic costs of an interruption even if it could replace all of the lost oil. The SPR could reduce the supply-induced impacts, but the demand-induced impacts would remain.

5. The optimal drawdown strategy of the SPR is to use as rapid a drawdown rate as possible up to the point where all of the lost oil is replaced.

Footnotes

[1] See R. Holcombe, "Taxation and Energy Policy," Oil & Gas Tax Quarterly 24,No. 2 (December 1977), pp. 224-233, and R. Holcombe, "Energy," in E. McAllister, ed., Agenda for Progress (Washington, D.C.: The Heritage Foundation, 1981), pp. 85-103.

[2] See R. Holcombe, "A Method for Estimating the GNP Loss from a Future Oil Embargo," Policy Sciences 8 (1977), pp. 217-234, and R. Holcombe, "An Evaluation of some Microeconomic Consequences of a Future Oil Embargo," Policy Sciences 10 (1979), pp. 207-220.

Senator WARNER. That is a very interesting perspective and one which is important to have as a part of the record. Of course, I am deeply concerned about the national defense aspect, and Senator Jackson and I have discussed this many times, and we are in total agreement on that, the need for this in the case of a cutoff.

Senator Matsunaga?

Senator MATSUNAGA. You expressed a very interesting viewpoint, one of which I myself have cogitated in my mind for some time, whether to buy it or not.

What concerns me is that we are not spending enough of our Federal effort toward development of alternative sources in order to become energy self-sufficient, and as you say, as a consequence, we suffer a deficit in our balance of trade.

However, the other concern is the international situation. What, in the event of an emergency, could we do to replace the loss of what is it now? We import about 6 million barrels of oil per day. What domestic alternative source of energy could replace that?

Dr. HOLCOMBE. Well, during the oil embargo of 1973 and 1974 and also during the Iranian Revolution when our imports were drastically reduced, we suffered through it. We certainly would have been better off in 1973 and 1974 had we had the strategic petroleum reserve, but we didn't, and we made it through the situation all right.

The drawdown, the current drawdown rate of 1.7 million barrels per day certainly would not do very much to replace the oil if all of our imports were cut off so that really the strategic petroleum reserve is not even designed to replace all of the imports that we would lose. Certainly if we had another oil embargo we would be happy to have the strategic petroleum reserve. The question is, What is the likelihood that we have another embargo, and what are we giving up in the meantime? Money that could be used for other things, and when I look at the cost and benefits, not only when I look at the cost and benefits, but if you look at the original strategic petroleum reserve plan in 1976, the Government's own analysis of the cost and benefit show at that time 500 million barrels was the optimal size of the reserve.

Since that time, with the escalating costs, unless we find something that they did wrong in their analysis, I would have to say that the optimal reserve would be much smaller since the cost has tripled since that time.

Senator MATSUNAGA. Your calculations relative to the cost/benefit ratio on what is now stored, is that based on the $14 per barrel which was spent on the first 100 million barrels?

Dr. HOLCOMBE. I haven't done a cost/benefit analysis on the oil that has already been stored.

Senator MATSUNAGA. You have not?

Dr. HOLCOMBE. No, I have not.

Senator MATSUNAGA. I have other questions, but I will submit them in writing.

Senator WARNER. Thank you very much. We will have a second hearing on this subject on the 25th of March.

[Whereupon, at 12:30 p.m., the hearing was recessed, to reconvene Thursday, March 25, 1982, at 10 a.m.]

BY THE COMPTROLLER GENERAL

Report To The Congress

OF THE UNITED STATES

Strategic Petroleum Reserve: Substantial Progress Made, But Capacity And Oil Quality Concerns Remain

During fiscal year 1981, the Government filled the Strategic Petroleum Reserve at an average rate of 292,000 barrels per day, the highest rate achieved for any fiscal year since oil fill began. This report discusses efforts since July 1980 to fill the reserve and notes that the Department of Energy will be able to maintain only an average rate of 189,000 barrels per day from fiscal year 1982 to 1989 under current expansion plans. It makes recommendations concerning the availability of storage capacity and the quality of oil stored in the reserve. It also includes matters for consideration by the Congress during the fiscal year 1983 budget process.

UNITED STATES GENERAL ACCOUNTING OFFICE

EMD-82-19
DECEMBER 31, 1981

COMPTROLLER GENERAL OF THE UNITED STATES
WASHINGTON D.C. 20548

B-203117

To the President of the Senate and the
Speaker of the House of Representatives

This report concludes our work under a July 1980 request from the Chairmen and eight members of the Senate Committee on Energy and Natural Resources and the former House Committee on Interstate and Foreign Commerce (now the House Committee on Energy and Commerce). The Committees asked us to provide periodic status reports and an overall report on the administration's efforts through fiscal year 1981 to fill the Strategic Petroleum Reserve in compliance with the Energy Security Act.

The report discusses efforts since July 1980 to fill the reserve. It makes recommendations to the Secretary of Energy concerning the availability of storage capacity and the quality of oil stored in the reserve. It also includes matters for consideration by the Congress during the fiscal year 1983 budget process. In order to meet the requestors' time frame to issue the report by January 1, 1982, we did not obtain official agency comments.

Copies of this report are being sent to the Director, Office of Management and Budget; the Secretary of Energy; the Secretary of Defense; and the Commander, Defense Fuel Supply Center.

Charles A. Bowsher
Comptroller General
of the United States

COMPTROLLER GENERAL'S
REPORT TO THE CONGRESS

STRATEGIC PETROLEUM RESERVE: SUBSTANTIAL PROGRESS MADE BUT CAPACITY AND OIL QUALITY CONCERNS REMAIN

DIGEST

The Federal Government's Strategic Petroleum Reserve (SPR) is vital to the Nation's efforts to protect itself against oil embargoes or temporary oil shortages. During an energy emergency the SPR's petroleum supplies would be an important addition to industry's supplies and would be used to supplement Federal and industry efforts to mitigate the effects of an interruption in the Nation's imported oil supplies.

Title VIII of the Energy Security Act (P.L. 96-294, June 30, 1980) requires the President to fill the SPR at an average rate of at least 100,000 barrels per day during each year until the reserve is filled. The Omnibus Budget Reconciliation Act of 1981 (P.L. 97-35, Aug. 13, 1981) requires that the President seek to fill the SPR at an average annual rate of at least 300,000 barrels per day.

This report follows nine status reports and concludes GAO's work under a July 23, 1980, request from members of the Senate Committee on Energy and Natural Resources and the former House Committee on Interstate and Foreign Commerce (now the House Committee on Energy and Commerce). In addition to the status reports, the committees requested an overall report by January 1, 1982, on the administration's activities to implement title VIII.

In order to meet the requestors' time frame, GAO did not obtain official agency comments on the report.

OVERVIEW OF FISCAL YEAR 1981 ACTIVITIES

During fiscal year 1981, the administration far surpassed the required minimum fill rate and almost met the higher fill goal by adding to the SPR at an average rate of about 292,000 barrels per day. This fill rate is the highest rate achieved for any fiscal year since the oil fill began.

By the end of fiscal year 1981, the SPR contained about 199 million barrels of oil, or more than twice the 93 million barrels that were in the SPR at the beginning of the year.

The administration used a variety of methods to obtain oil during fiscal year 1981. The Defense Fuel Supply Center, the Department of Energy's (DOE's) purchasing agent for most SPR oil, acquired oil through a competitive exchange of Naval Petroleum Reserve oil and through an open continuous solicitation of oil available on the spot, or short-term, market. In addition, DOE acquired oil under a multi-year contract with Petroleos Mejicanos (PEMEX), the Mexican State oil company.

FUTURE FILL RATE CONSTRAINED BY CAPACITY

DOE's storage expansion plans provide for an average fill rate of 189,000 barrels per day during fiscal years 1982 through 1989. Although this rate will far exceed the minimum statutory requirement of 100,000 barrels per day, it falls considerably short of the 300,000-barrels-per-day fill rate goal set in the Omnibus Budget Reconciliation Act. The average fill rate could even be less if existing construction problems at some SPR sites continue or new problems cause further schedule slippage.

In July 1981, DOE reported on options for increasing the SPR fill rate. However, DOE considered only those options which increase the size of the reserve and assumed that the schedule for completing a 750-million-barrel reserve would be maintained.

GAO believes that DOE's assessment should have addressed additional options, and it questions the soundness of some key assumptions. For example, the study did not assess options for filling a smaller reserve at the 300,000-barrels-per-day rate nor other options such as leasing temporary storage.

An accelerated SPR program would have significant budget implications because, in addition to facilities' costs, oil acquisition costs would be spread over fewer years and necessitate higher funding levels in the early 1980s.

As required by the Omnibus Budget Reconciliation Act of 1981, DOE is conducting a study of the costs and benefits of the currently planned 750-million-barrel SPR and any other larger or smaller final storage capacities which might be appropriate. This study is scheduled to be completed in February 1982.

Depending on decisions on the final size of the reserve, the fill rate, and funding levels, DOE may need to alter its current capacity expansion plans. To assist the Congress in its deliberations over appropriate SPR funding levels, we believe DOE should more fully assess the costs and benefits of alternatives to its current expansion plans. The Congress may then wish to reaffirm or provide new guidance on the desired SPR fill rate.

DOE PURCHASES HEAVIER CRUDES

In the event of a drawdown, SPR crude oil must be refined into petroleum products before it is used by consumers. U.S. refineries can produce a range of products, such as gasoline, kerosene and jet fuels, heating oil, lubricants, waxes, asphalt, and coke, in descending order from lightest to heaviest. The proportion of these products varies with refinery design, market demand, and with the physical characteristics, or quality, of the crude oil used. The quality of the SPR oil, therefore, is an important determinant of the amount of specific petroleum products available to the Nation during an interruption.

DOE's original crude oil quality specifications and oil acquisition strategy were based on a 1976 assessment of refinery product needs and capabilities. DOE modified its acquisition strategy during fiscal year 1981 to accept Alaskan North Slope and Mexican crudes that are heavier than oil previously purchased, without conducting a similar assessment. Although DOE awarded a $258,000 contract in May 1981 to perform such an analysis, the study will not be completed until August 1982. In the interim, DOE has continued to purchase lower quality oil without the needed analysis.

By December 1, 1981, 40.3 million barrels--18 percent--of the 223 million barrels of oil that the SPR had received were heavier crudes. Depending on the ultimate size of the reserve and the amount of heavier crude oil it contains, this percentage could change. Consequently, the likely impact of the heavier crudes on the mix of oil products which might be available is not known at this time.

RECOMMENDATIONS

GAO recommends that the Secretary of Energy:

--Evaluate options for achieving an average annual fill rate of 300,000 barrels per day assuming the planned and other SPR sizes. The evaluation, which should be available for fiscal year 1983 congressional budget deliberations, should assess costs and benefits of alternatives to constructing new underground storage facilities, including such options as leasing existing storage capacity.

--Emphasize crude oil quality in acquiring oil for the SPR under current specifications, to the extent that availability and prices of such crudes allow.

--Require that the Deputy Assistant Secretary for the SPR document the rationale for any future lowering of SPR oil quality specifications. Such documentation should address key reasons for the change, such as the availability and comparative costs of higher quality crude oils.

--Make a decision no later than September 30, 1982, on whether the quality specifications and acquisition strategy for SPR oil should be revised. The results of the ongoing studies of oil quality and the size of the reserve should be useful in making that determination.

MATTERS FOR CONSIDERATION BY THE CONGRESS

As part of the fiscal year 1983 budget process, the Congress should explore with the Department of Energy the matters discussed in this report regarding its current capacity expansion plans and options to achieve an average annual fill rate of 300,000 barrels per day until the SPR is filled. Based on its evaluation, the Congress should reaffirm or provide new guidance on its desired SPR fill rate.

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ABBREVIATIONS

ANS	Alaskan North Slope
API	American Petroleum Institute
DFSC	Defense Fuel Supply Center
DOE	Department of Energy
DUCI	Dravo Utility Constructors, Inc.
FEA	Federal Energy Administration
GAO	General Accounting Office
NPR	Naval Petroleum Reserve
PEMEX	Petroleos Mejicanos
SPR	Strategic Petroleum Reserve

CHAPTER 1

INTRODUCTION

The Federal Government's Strategic Petroleum Reserve (SPR) is vital to the Nation's efforts to protect itself against oil embargoes or temporary oil shortages. During an energy emergency, the SPR's petroleum supplies would be an important addition to industry's supplies and would be used to supplement Federal and industry efforts to mitigate the effects of an interruption in the Nation's imported oil supplies.

The Energy Policy and Conservation Act of 1975 (P.L. 94-163) authorized the creation of an SPR to provide for storage of up to 1 billion barrels of crude oil. To implement this program, the Federal Energy Administration (FEA) 1/ released its Strategic Petroleum Reserve Plan on December 15, 1976. This plan called for a reserve of 150 million barrels by December 1978 and 500 million barrels by December 1982. In March 1977, FEA announced the acceleration of SPR development and established more optimistic goals for filling the reserve--250 million barrels by the end of 1978 and 500 million barrels by the end of 1980.

These goals proved to be overly optimistic, and the program experienced a number of problems during its first 5 years. Construction progressed at a slower rate than anticipated because of technical problems. The cost of developing SPR storage facilities escalated because of unrealistic cost estimates, which were based on preliminary feasibility studies rather than engineering designs; accelerated construction schedules; and cost control problems. In addition, the Department of Energy (DOE) suspended oil purchases in April 1979 because of a worldwide shortage of oil during early 1979. 2/

The suspension of oil purchases continued into 1980 and as of June 30, 1980, the Government had not resumed oil purchases for the SPR. At that time, the SPR contained about 91 million barrels of oil. Although this was the equivalent of about a 2-week supply at the average 1980 crude oil import rates, the drawdown capability of the reserve was limited to about 1 million barrels per day.

In part, to encourage the Government to resume oil purchases and continue filling the SPR, the Congress passed the Energy Security Act (P.L. 96-294), which the President approved on

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1/The functions of the Federal Energy Administration were assigned to DOE on Oct. 1, 1977, pursuant to the Department of Energy Organization Act (P.L. 95-91).

2/We have been reviewing the development of the SPR since its inception and have reported on these and other issues which affected the SPR's progress. Appendix II lists our reports on the SPR.

June 30, 1980. Title VIII of the act requires the President to fill the SPR at an average rate of at least 100,000 barrels per day for fiscal year 1981 and each succeeding fiscal year until the SPR is filled. It also states that Elk Hills Naval Petroleum Reserve oil may not be sold unless the SPR is filled at an average rate of at least 100,000 barrels per day during fiscal year 1981 and succeeding years until the reserve reaches 500 million barrels. The Omnibus Budget Reconciliation Act of 1981 (P.L. 97-35, Aug. 13, 1981) requires that the President seek to fill the SPR at an average annual rate of at least 300,000 barrels per day.

On July 23, 1980, members of the Senate Committee on Energy and Natural Resources and the former House Committee on Interstate and Foreign Commerce (now the House Committee on Energy and Commerce) requested that we provide periodic status reports and an overall report to the Congress on the administration's activities between July 1980 and October 1981 to implement title VIII. (See app. I for the letter requesting these reports.) In response to this request, we issued nine reports between September 23, 1980, and October 2, 1981, on the status of SPR activities. We also provided testimony on the status of SPR activities to a subcommittee of the House Committee on Energy and Commerce on March 18, 1981, and to a subcommittee of the Senate Committee on Energy and Natural Resources on March 30, 1981.

SPR OIL STORAGE FACILITIES

DOE--the primary agency responsible for developing and operating the SPR--is implementing a three-phased program to develop a 750-million-barrel SPR. Although the Energy Policy and Conservation Act authorizes a 1-billion-barrel SPR, the administration has not decided whether the final 250 million barrels of storage capacity will be built. DOE currently is conducting a study required by the Omnibus Budget Reconciliation Act of 1981 (P.L. 97-35, Aug. 13, 1981) on the costs and benefits of the currently planned size of the SPR and any other larger or smaller sized reserve which might be appropriate. DOE expects to complete this study by February 1982.

Phase I of the program involved developing five oil storage sites on the Gulf Coast in Texas and Louisiana with a combined storage capacity of about 250 million barrels. About 98 percent of this capacity was available for oil storage by the end of October 1981. The Phase I sites consist of a single underground salt mine and a number of underground salt caverns for storing the oil, and related systems for moving and safeguarding the oil including pipelines, pumps, wells, firefighting and security systems, and maintenance buildings. Phase I also involved constructing a Government-owned oil receiving terminal on the Mississippi River at St. James, Louisiana, and negotiating multiyear contracts with the Sun Oil Company (Sunoco) and Seaway, Inc., to use their commercial terminal facilities at Nederland and Freeport, Texas, respectively, for receiving oil which is destined for SPR storage facilities. The five Phase I storage sites, and the terminals which initially receive oil destined for these facilities, are

--the Weeks Island and Bayou Choctaw, Louisiana, storage sites, which are connected via pipelines to DOE's St. James terminal,

--the West Hackberry and Sulphur Mines, Louisiana, storage sites, which are connected via pipelines to the Sunoco terminal, and

--the Bryan Mound, Texas, storage facility, which is connected via pipeline to the Seaway, Inc. terminal.

The locations of these storage facilities and terminals are shown in figure 1.

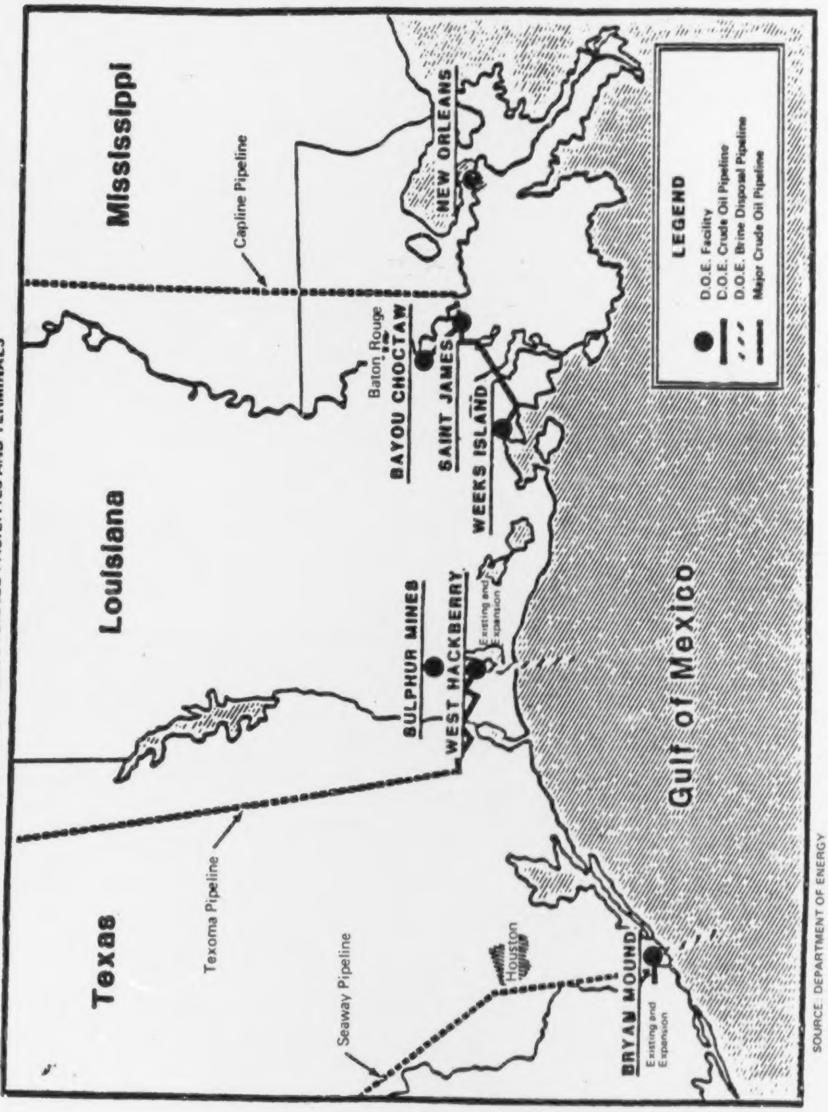
Phase II of the program started in 1979 and involves adding about 290 million barrels of storage capacity at three of the existing storage sites by the end of 1987. DOE plans to create this additional storage capacity by leaching caverns in underground salt formations--a process that involves pumping water into a salt formation and removing the salt-saturated water, or brine. The additional capacity would bring SPR storage capacity to about 540 million barrels.

DOE's current plans for Phase III involve adding a sixth storage site and expanding two existing sites to bring total SPR storage capacity by the end of 1989 to about 750 million barrels. DOE's plans indicate that the Phase III capacity would also be created by leaching caverns in underground salt formations.

ORGANIZATIONS RESPONSIBLE FOR SPR ACTIVITIES

Figure 2 illustrates DOE's organizational responsibilities for SPR activities. The Washington, D.C., SPR program office is headed by DOE's Deputy Assistant Secretary for the SPR, who reports to DOE's Assistant Secretary for Environmental Protection, Safety and Emergency Preparedness. The Deputy Assistant Secretary is responsible for overall program management, program planning, and development and operation of the SPR. The New Orleans, Louisiana, SPR project office, which reports to the Deputy Assistant Secretary, is responsible for the day-to-day design, development, construction, and operation and maintenance of SPR facilities. This includes scheduling oil deliveries to terminals associated with SPR storage facilities, and managing about 27 contractors. These contractors are involved in operating and maintaining SPR storage facilities, installing pipelines, leaching additional storage capacity, and carrying out other construction activities associated with expansion of SPR facilities.

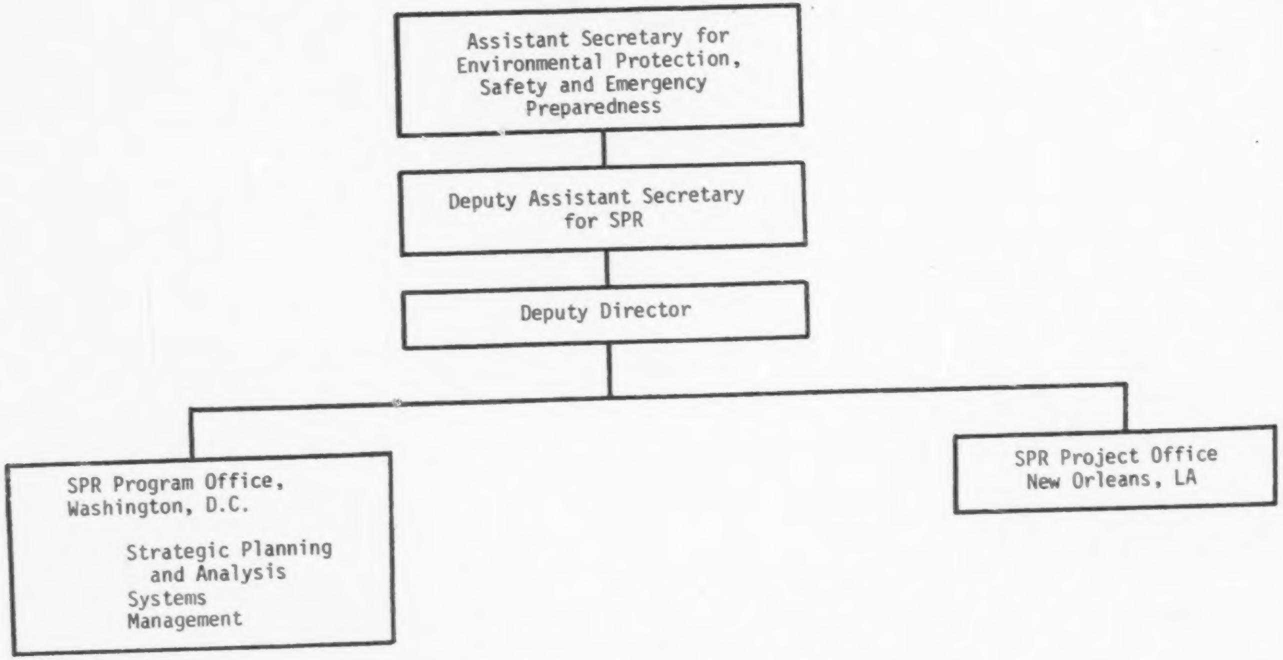
FIGURE 1
LOCATIONS OF SPR STORAGE FACILITIES AND TERMINALS


Mississippi
Louisiana
Texas
Capline Pipeline
Texoma Pipeline
Seaway Pipeline
Houston
Baton Rouge
NEW ORLEANS
BAYOU CHOCTAW
SAINT JAMES
WEEKS ISLAND
SULPHUR MINES
WEST HACKBERRY
Existing and Expansion
BRYAN MOUND
Existing and Expansion
Gulf of Mexico
LEGEND
● D.O.E. Facility
D.O.E. Crude Oil Pipeline
D.O.E. Brine Disposal Pipeline
Major Crude Oil Pipeline

SOURCE: DEPARTMENT OF ENERGY

Figure 2

DOE Organizational Chart for SPR


Assistant Secretary for Environmental Protection, Safety and Emergency Preparedness
Deputy Assistant Secretary for SPR
Deputy Director
SPR Program Office, Washington, D.C.
Strategic Planning and Analysis
Systems Management
SPR Project Office New Orleans, LA

Source: Department of Energy

As a result of a 1977 interagency agreement between FEA and the Department of Defense, the Defense Fuel Supply Center (DFSC) is the purchasing agent for most SPR oil. However, according to the interagency agreement, DOE can acquire oil for the SPR through contracts on a government-to-government basis. DOE initiates SPR oil procurements by issuing administrative oil acquisition orders to DFSC. These orders transfer funds and specify the volume and type of crude oil to be acquired. DFSC is responsible for issuing solicitations which request offers to sell or exchange oil for delivery to the SPR, negotiating final offers, and awarding contracts for oil deliveries.

OBJECTIVES, SCOPE, AND METHODOLOGY

This report concludes our work under the July 1980 request to report to the Senate Committee on Energy and Natural Resources and House Committee on Energy and Commerce on the administration's efforts to fill the SPR in compliance with the Energy Security Act. As agreed with the Committees' offices, the report

--summarizes the administration's fiscal year 1981 efforts to fill the SPR,

--discusses DOE's efforts to expand storage capacity and the consequent effect on the rate at which DOE can fill the SPR during fiscal year 1982 and succeeding years, and

--reviews the basis for DOE decisions concerning the quality of oil to be stored in the SPR.

Our overview of fiscal year 1981 oil fill efforts relies heavily on the nine status reports we issued to the Committees during the year. It includes a summary of fiscal year 1981 contracting efforts to purchase oil for the SPR, the availability of funds for SPR purchases, the readiness of SPR facilities to receive oil throughout the fiscal year, and the status of oil deliveries. We also obtained additional information from interviews with DFSC officials concerning oil contracts, and from DOE's SPR program office and Office of Controller, DFSC, and the Office of Management and Budget concerning the status of funds appropriated for SPR oil acquisition.

To evaluate DOE's efforts to expand storage capacity, we reviewed DOE's fiscal year 1980 and 1981 Annual SPR Reports; its November 1980 strategy for leaching Phase II caverns; its fiscal year 1982 SPR budget request dated March 10, 1981; a July 1981 study prepared for the Secretary of Energy on options for accelerating development of SPR storage capacity; and other program documents. We interviewed DOE officials in the Washington, D.C., SPR program office and the New Orleans, Louisiana, SPR project office. Our work also included on-site visits to each of the five Phase I storage sites and the three oil-receiving terminals, interviews with DOE contractors involved in capacity expansion, and observation of meetings between DOE project officials and contractors to determine the effect on future oil fill rates of DOE's capacity expansion activities.

To evaluate the basis for DOE decisions concerning the quality of oil stored in the SPR, we reviewed the 1976 SPR Plan, a 1976 contractor report, internal memoranda, and DOE's July 1981 plan for withdrawing and allocating SPR oil. Due to the lack of documented information concerning the rationale for recent changes in the oil acquisition plan and oil quality specifications, we relied heavily on interviews with DOE and DFSC officials. We also discussed with U.S. refining industry and trade association officials the implications of the quality of oil stored in the SPR on U.S. refiners' ability to provide needed products during an oil supply interruption, and reviewed the National Petroleum Council's December 1980 report on "Refinery Flexibility".

In order to meet the requestors' January 1, 1982, time frame for the report, we did not review DOE's controls over, or verify, the volumes and quality of oil reported received, the reasonableness of prices paid for SPR oil, the performance of DOE contractors, or the administration's efforts to determine what the final size of the SPR should be. In addition, we did not attempt to determine the optimum fill rate for the SPR. However, we plan to continue reviewing SPR activities, including a number of these areas, in the next year.

Because of time constraints imposed by the request, we did not obtain official agency comments. However, we provided DOE and DFSC program officials a draft of this report prior to a meeting in which both the factual accuracy as well as the tentative conclusions and recommendations were discussed. Based on these comments we made appropriate revisions to the report.

CHAPTER 2

SPR FILLED AT AN AVERAGE RATE OF 292,000 BARRELS PER DAY

DOE estimates that, during fiscal year 1981, SPR facilities received about 107 million barrels of crude oil. These deliveries were equivalent to an average fill rate of about 292,000 barrels per day during the fiscal year, far exceeding the minimum 100,000-barrels-per-day rate required by the Energy Security Act and the administration's March 1981 budget goal of an average rate of 207,000 barrels per day during the fiscal year. In addition, the rate is close to the 300,000-barrels-per-day goal set forth in the Omnibus Budget Reconciliation Act.

This chapter summarizes the administration's SPR oil contracting and fill activities during fiscal year 1981, including the availability of funds for SPR purchases and the ability of individual sites to receive oil.

SPR OIL FILL ACTIVITIES

During fiscal year 1981, the administration used a variety of methods to obtain oil for the SPR. Initially, the administration concentrated on meeting the Energy Security Act's minimum 100,000-barrels-per-day fill requirement through the competitive exchange of Naval Petroleum Reserve oil for oil delivered to the SPR and by establishing regulations that, if implemented, would have assured that the minimum fill rate would be met by requiring companies to provide oil to the SPR if the competitive exchange did not succeed. In January 1981, the administration began to solicit offers for oil available on the "spot", or short-term, market which allowed the administration to exceed the minimum fill rate for the first time. In August, DOE signed a contract for a long-term supply of oil for the SPR with Petroleos Mejicanos (PEMEX), the Mexican State oil company, for up to 110 million barrels of oil. These efforts allowed the SPR to achieve an average fill rate during fiscal year 1981 of 292,000 barrels per day.

Fiscal year 1981 exchange of Naval Petroleum Reserve oil

During the summer of 1980, DOE began to acquire oil for the SPR through the competitive exchange of 36.7 million barrels of crude oil from the Naval Petroleum Reserve (NPR) at Elk Hills, California, for an equal volume of oil to be delivered to the SPR. DOE's authority to use Elk Hills oil for the SPR was originally set out in the Energy Policy and Conservation Act of 1975 and was restated in the Energy Security Act. The Energy Security Act also stipulates that Elk Hills oil cannot be sold or otherwise disposed of unless the SPR is being filled at the act's required minimum average fill rate of 100,000 barrels per day. Although other options were available to acquire oil, such as an open solicitation or use of Federal royalty oil, DOE believed that using the federally owned NPR oil would guarantee availability of about 100,000 barrels per day of domestically produced oil for the SPR, present less administrative problems, and require less time to implement than using Federal royalty oil. The administration did not purchase oil on the world market, citing its June 1979 agreement to refrain from foreign oil purchases when such activities would place "undue pressure" on world oil prices.

On August 11, 1980, the Defense Fuel Supply Center (DFSC) issued a solicitation for the competitive exchange of NPR oil. On September 18, and October 1, 1980, DFSC awarded contracts for a total of about 24 million barrels, or about 65,000 barrels per day of the 100,000-barrels-per-day NPR production for which DFSC initially requested offers.

As a result, on October 3, 1980, DFSC issued a supplemental solicitation to exchange the remaining 35,000 barrels per day of NPR oil. This solicitation, however, broadened the oil quality specifications to allow companies to offer for the first time heavier Alaskan North Slope oil [1] in exchange for NPR oil. The awards made in October 1980 under the supplemental solicitation, brought the total amount exchanged to 36.7 million barrels or about 100,000 barrels per day. (See app. III for information on the types of oil acquired, proposed delivery schedules, and prices as a result of DFSC's initial and supplemental solicitations for the NPR exchange.)

The first oil delivered as a result of the competitive exchange was received at DOE's St. James terminal on September 23, 1980; by the start of fiscal year 1981, 1.6 million barrels had been delivered. During fiscal year 1981, DOE received 34.8 million barrels under the exchange. Between the end of fiscal year 1981 and December 1, 1981, DOE received an additional 500,000 barrels under the exchange. The total volume of oil delivered under the exchange was 36.9 million barrels, or 200,000 barrels more than the amounts specified in the contracts. Deliveries exceeded contract amounts as allowed under the terms of DFSC's contracts.

Mandatory requirements to ensure minimum SPR oil fill

In addition to the NPR exchange, on January 5, 1981, DOE's Economic Regulatory Administration finalized regulations amending mandatory price and allocation controls established under the Emergency Petroleum Allocation Act of 1973 (P.L. 93-159). Those amendments would have required refiners to provide oil to the SPR if the voluntary, competitive exchanges of NPR oil did not reach the 100,000-barrels-per-day minimum requirement. However, on January 28, 1981, the President removed remaining price and allocation controls on crude oil and refined petroleum products. The removal of allocation controls effectively nullified the SPR allocation regulations related to the mandatory requirement.

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[1] Heavy oil is defined in terms of American Petroleum Institute (API) gravity. API gravity is a measure of the mass of a fluid relative to water and ranges from 10 degrees for very heavy crude to 45 degrees for very light crude. ANS oil is about 26 degrees API gravity, whereas most oil accepted for the SPR has an API gravity of between 30 degrees and 44 degrees.

Additional contracts issued to accelerate fill rate

Until January 1981, DOE directed most of its attention to meeting the minimum supply requirement of the Energy Security Act. However, on January 27, 1981, DOE's Deputy Assistant Secretary for the SPR signed an oil acquisition order which authorized DFSC to issue a solicitation for the delivery of additional oil during the fiscal year. Three days later, DFSC issued an open continuous solicitation for SPR oil. DFSC was able to quickly issue the solicitation, in part, because as early as August 13, 1980, DOE's SPR program office had requested DFSC to prepare the solicitation and be ready to issue it upon notice from DOE.

DFSC officials refer to the January 1981 solicitation as an "open continuous solicitation" because, unlike its 1980 solicitation to exchange NPR oil for oil to be delivered to the SPR, the January 1981 solicitation allowed companies to repeatedly submit offers to sell oil to the SPR, receive contracts, and submit offers to sell additional oil without DFSC readvertising the solicitation.

The solicitation invited companies to submit offers to sell oil to the SPR on a regular basis. The first cutoff date for receiving offers was February 10, 1981. DFSC uses a range of market prices paid for similar types of oils to evaluate the reasonableness of the prices offered prior to making periodic awards under the solicitation.

The solicitation requested crude oils meeting the SPR specifications and included Alaskan North Slope oil and blends of oil. It also allowed offers for a minimum quantity of 240,000 barrels of oil delivered by ship or 50,000 barrels delivered by pipeline. These offers generally involve oil available on the spot market which is available for immediate delivery.

DFSC has continued to receive offers and award contracts for delivery of SPR oil under the open continuous solicitation. As of December 1, 1981, DFSC had awarded 40 contracts to 19 companies in response to the solicitation. (See app. III for information on individual contracts.) These contracts called for the delivery of about 66.8 million barrels of oil during fiscal year 1981, and delivery of about 15.3 million barrels of oil during fiscal year 1982. However, because of changes in delivery schedules, DOE actually received 68.1 million barrels under the open continuous solicitation during fiscal year 1981.

Initial deliveries under August 1981 Petroleos Mejicanos (PEMEX) contracts boost 1981 fill rate

In addition to oil received under the NPR exchange and the open continuous solicitation, DOE received 3.6 million barrels of oil during fiscal year 1981 as a result of an August 1981 multi-year DOE contract with Petroleos Mejicanos (PEMEX), Mexico's State oil company. The Mexican oil boosted the total oil delivered to SPR facilities during the fiscal year to about 107 million barrels, or an average fill rate of about 292,000 barrels per day for the entire fiscal year.

DOE's multi-year contract with PEMEX calls for delivery to the SPR of 6 million barrels of a heavy, high-sulfur crude oil referred to as Maya crude, and up to 104 million barrels of a blend of Maya and Isthmus, a lighter, lower sulfur Mexican crude oil. According to the contract, about 24 million of the 110 million barrels is to be delivered by December 31, 1981. After that date, DOE will receive oil under the contract at an average rate of about 50,000 barrels per day until August 31, 1986. As of December 1, 1981, DOE had received about 14.4 million barrels of Mexican oil. This included 6.5 million barrels of Maya crude, 6.9 million barrels of the blend of crudes, and 1 million barrels of Isthmus crude.

Quality specifications for the Isthmus crude indicate that it is comparable to other high-sulfur crude acquired for the SPR. Quality specifications for the Maya crude indicate it is a significantly inferior quality oil compared to other crude oils stored in the SPR. The quality of the Maya crude is discussed in more detail in chapter 4.

FACTORS CONTRIBUTING TO DOE'S SUCCESSFUL FISCAL YEAR 1981 OIL FILL RATE

DOE's achievement of a high fill rate during fiscal year 1981 was assisted by three key factors:

- --The availability of sufficient funds to purchase the oil.
- --A decrease in worldwide oil demand, while world production stayed relatively constant, resulting in an increase in oil supplies and a decrease in oil prices.
- --The availability of DOE storage capacity and ability of terminals to handle varying receiving rates.

Funds available during fiscal year 1981

As indicated in table 1, during fiscal year 1981, about $5.3 billion was available to finance SPR oil purchases. Because of the suspension of oil purchases between April 1979 and August 1980, DOE had nearly $2.1 billion in funds appropriated in prior years available for oil purchases during fiscal year 1981. In addition, the Department of the Interior and Related Agencies Appropriation Act of 1981 (P.L. 96-514, Dec. 12, 1980) provided about $1.4 billion for fiscal year 1981 oil acquisition. Other funds also available for oil purchased during fiscal year 1981 consisted of $542 million from the sale of entitlements 1/ earned as a result of title VIII of the Energy Security Act and $1.3 billion in supplemental funds under the Supplemental Appropriation and Rescission Act of 1981 (P.L. 97-12, Jun. 5, 1981).

As of October 1, 1981, about $634 million of the total $5.3 billion available for fiscal year 1981 had not been committed for SPR oil acquisitions. DOE had transferred about $609 million of the remaining funds to DFSC which are available for fiscal year 1982 oil purchases. During fiscal year 1981, DOE requested and received congressional approval to reprogram $25 million of oil acquisition funds to pay two separate settlements associated with acquiring land for Phase I facilities. DOE reprogrammed $18 million in June 1981 for a settlement on the Bryan Mound site and $7 million in September 1981 for a settlement on the West Hackberry site.

Under the October 1, 1981, joint continuing resolution for fiscal year 1982 (P.L. 97-51), DOE was provided an additional $2.68 billion for SPR oil fill. These funds were placed in an off-budget SPR oil acquisition account established by the Omnibus Budget Reconciliation Act of 1981. According to the act, these off-budget funds are not to be counted in the Government's total expenses for the fiscal year. However, similar

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1/The entitlements program was designed to distribute the benefits of price controls on domestic crude oil among refiners. An entitlement was the right to refine a barrel of price-controlled domestic oil. Refiners bought and sold entitlements, calculated monthly by DOE as the difference between the average price of controlled and uncontrolled oil adjusted by volume of each category of oil sold, to permit them to process their monthly volume of controlled oil. The program required refiners who processed more than the national average of controlled oil to buy entitlements from refiners who processed less than the national average. Cash received in exchange for entitlements sold in effect reimbursed refiners who were selling entitlements for part of the higher purchase cost of uncontrolled oil. The entitlements program ended as a result of the President's January 28, 1981, decision to decontrol oil.

Table 1

Fiscal Year 1981 Funding for SPR Oil Acquisitions

(billion)

Funds available for fiscal year 1981:		
Prior years' funds		$2.093
Fiscal year 1981 appropriations		1.383
Entitlements (earned on fiscal year 1981 deliveries prior to decontrol on January 28, 1981)		.542
Fiscal year 1981 Supplemental Appropriations		1.305
Total funds available for fiscal year 1981 oil purchases		5.323
Fiscal year 1981 contracts:		
Competitive exchange (36.6 million barrels)	$1.441	
Open continuous solicitation (79.1 million barrels) (note a)	2.815	
PEMEX purchase	b/ .433	
Total value of fiscal year 1981 contracts		4.689
Oil funds reprogrammed for SPR land settlements (note c)		.025
Total fiscal year 1981 commitments		4.714
Fiscal year 1981 funds remaining for oil purchases		$ .609

a/As of October 1, 1981, about 12 million barrels of oil had been purchased under the solicitation for fiscal year 1982 delivery, at a total price of about $418 million.

b/According to DOE officials, these funds have been obligated to procure oil under the contract through October 31, 1981. The funds were transferred to the SPR project office in New Orleans, Louisiana, which is the contract administration office for the PEMEX contract.

c/As of October 1, 1981, DOE had received congressional approval to reprogram about $18 million of fiscal year 1981 oil acquisition funds for a settlement resulting from DOE's condemnation of land for the Bryan Mound site and about $7 million for a similar settlement on West Hackberry land.

Source: Department of Energy, Defense Fuel Supply Center.

to on-budget items, the U.S. Treasury will continue to borrow funds to finance such outlays.

On December 23, 1981, the President signed Public Law 97-100, the Department of the Interior and Related Agencies Appropriation Act of 1982. The act provides about $3.68 billion for fiscal year 1982 SPR oil acquisitions.

Together with the $609 million of fiscal year 1981 SPR oil acquisition funds which were not committed as of October 1, 1981, the $3.68 billion fiscal year 1982 appropriations bring total funds available to date, to $4.29 billion. According to DOE estimates, at $39 per barrel including transportation costs, these funds would allow DOE to purchase about 110 million barrels of oil during fiscal year 1982 and would support a fill rate of about 300,000 barrels per day if all oil purchased in fiscal year 1982 were delivered in the same year. However, according to DOE officials, they plan to spend about $1.4 billion for advance purchases for fiscal year 1983 deliveries.

Drop in world oil prices

The Government was able to achieve an average 292,000 barrels-per-day SPR oil fill rate during fiscal year 1981 in part because a drop in world oil prices made it economically advantageous. About 39 million barrels, which is over one-half of the 67 million barrels of oil acquired on the spot market during fiscal year 1981 was purchased during February 1981 and March 1981. This occurred after spot market prices for various types of crude oil dropped $2 to $4 per barrel from prices for similar crude sold during the first week of January 1981. The Government's largest, single day purchase of oil on the spot market since the beginning of the program came at the end of these 2 months, when on March 31, 1981, the Government purchased 22.4 million barrels of oil.

As a result of the lower prices, in its mid-year report to the Congress on the fiscal year 1982 budget request, the administration decreased its projection of the average fiscal year 1981 and 1982 oil purchase price by $2.50 per barrel. In that report, the administration announced that to take advantage of decreasing world oil prices, it planned to buy about 28 million barrels more than the 75.6 million barrels needed to achieve the 207,000 barrels-per-day fiscal year 1981 fill rate shown in its March 10, 1981, budget proposal. By the end of the fiscal year, DFSC had purchased about 30 million barrels of oil more than needed to achieve the budgeted fill rate.

Phase I receiving and storage capacity

During fiscal year 1981, DOE had storage capacity available to receive an average 292,000 barrels per day at each of its five Phase I storage sites. Although the Bryan Mound, West Hackberry, and Bayou Choctaw sites had been partially filled with oil prior to the suspension of SPR oil purchases in April 1979, storage space was available at these sites when DOE received the first delivery of NPR exchange oil on September 23, 1980. DOE also completed preparing and testing the Weeks Island site in November 1980 and a 6.7 million barrel cavern at Sulphur Mines in July 1981. DOE completed retesting the 8 million barrel cavern involved in the September 1978 fire at West Hackberry in July 1981. Because capacity was available at each of the storage sites, DOE also was able to receive oil through each of the three terminals during fiscal year 1981.

DOE's SPR oil fill rate is also affected by the sulfur content of oil being delivered. DOE segregates the oil stored in SPR facilities so that low-sulfur oils are stored in certain caverns and high-sulfur oils are stored in other caverns and the salt mine. In addition, low- and high-sulfur oils are not transferred through a pipeline at the same time.

As of October 1, 1981, DOE had designated about 63 percent of its Phase I capacity to store high-sulfur crude oils. This includes the 75 million barrel Weeks Island facility, 36 million barrels of capacity at West Hackberry, the total 26 million barrels of capacity at Sulphur Mines, and about 26 million barrels of capacity at Bayou Choctaw.

SPR oil fill rates varied from about 125,000 to 190,000 barrels per day between October 1, 1980, and the end of March 1981 when DOE was primarily using the Seaway and Sunoco terminals to deliver low-sulfur oil to Bryan Mound and West Hackberry and the St. James terminal to deliver high-sulfur oil to Weeks Island. After DOE began receiving oil as a result of the NPR exchange and the January 1981 open continuous solicitation, the average oil fill rate increased to between 375,000 and 513,000 barrels per day each month until the end of the fiscal year. Between October 1, 1981, and December 1, 1981, DOE received oil at an average rate of 305,000 barrels per day. (See app. III.)

Although DOE made sufficient capacity available during fiscal year 1981 to receive oil at an average rate of 292,000 barrels per day, DOE has experienced delays in bringing on-line the 26-million-barrel Sulphur Mines capacity. In our November 1980 SPR status report, we noted that DOE officials stated that this facility would be ready for oil fill during December 1980. DOE officials later changed the facility's estimated availability date to July 1981. DOE completed testing of a 6.7 million barrel cavern during July, but did not complete work on another 5.9 million barrel cavern until September 1981. DOE also has revised the estimated date for completing work on the site's remaining 13.1 million barrel cavern to January 1982. According to DOE officials additional time was needed to locate and repair leaks detected in wells and to plan and conduct tests at the 13.1 million barrel cavern.

CHAPTER 3

DOE CAPACITY EXPANSION PLANS

Under existing storage expansion plans, DOE will not have sufficient storage capacity available during fiscal year 1982 to receive oil at 300,000 barrels per day. The 199 million barrels of oil in the ground as of September 30, 1981, plus the 110 million barrels needed to maintain an average 300,000 barrels-per-day fill rate would bring the SPR oil inventory at the end of fiscal year 1982 to 309 million barrels. This is about 42 million barrels more than DOE estimates it will have the capacity to receive.

The availability of SPR storage capacity is an issue we have addressed in several monthly SPR status reports and one requiring DOE's constant attention. In our February report, 1/ we stated that due to capacity constraints, DOE would not be able to sustain a fill rate of 300,000 barrels per day beginning in June 1981 for more than about 1 year. We recommended that the Secretary of Energy ensure that adequate capacity is available on a timely basis to meet the need of accelerated fill efforts. In addition, we recommended that the Secretary report to the Congress on the costs, advantages, and disadvantages of an accelerated construction program and other storage options.

The Omnibus Budget Reconciliation Act of 1981 states that the President shall seek to fill the SPR at an average annual rate of at least 300,000 barrels per day until the SPR oil inventory reaches 750 million barrels. However, DOE's current plans to create and fill 750 million barrels of storage capacity by the end of fiscal year 1989 allow for an average rate of only 189,000 barrels per day during fiscal years 1982 through 1989.

CREATING CAVERNS--WHAT'S INVOLVED

Creating new storage caverns involves a three-stage process of drilling wells, testing these wells for pressure losses, and leaching--injecting water into underground salt formations and removing the salt-saturated water, or brine. Wells, which are used for leaching, oil fill, and oil withdrawal, are drilled through sand and rock into the salt formation. These wells are lined with steel casings which are set in concrete to set off fresh water beds and other formations. After a well's casing is tested for pressure leaks and found to have none, a well is certified and leaching begins.

1/"Status of Strategic Petroleum Reserve Activities--February 1981" (EMD-81-19, Feb. 24, 1981).

DOE plans to keep the caverns filled with varying proportions of brine and oil during the leaching process. As a cavern grows, the volume of oil that can be injected increases. During the initial stages of leaching, which include developing the central core, or chimney, of the cavern; the bottom, or sump, of the cavern; and the cavern's roof, only about 250,000 barrels of oil, or about 555 barrels per day, are injected into the cavern. Based on DOE's leaching plan, these stages are generally completed within about 450 days after leaching begins. To expand the cavern, DOE then leaches from the roof to the bottom of the cavern. During these stages of leaching, DOE injects an average of about 20,000 barrels of oil per day.

DOE's brine disposal rate and the rate at which DOE can inject water into new caverns at Bryan Mound and West Hackberry are key factors affecting the leaching rate. DOE estimates that, for every barrel of capacity created, it must inject seven barrels of water and remove seven barrels of brine. Electric pumps are used to obtain water from a nearby river, lake, or canal and inject the water into a cavern. Incoming water forces brine within the cavern to the surface, where it is temporarily kept in man-made storage ponds. The brine is then disposed of using pumps and pipelines to either the Gulf of Mexico or underground brine wells within limits allowed by environmental permits.

STATUS OF PHASE I AND II STORAGE CAPACITY

As of December 1, 1981, DOE had ready for oil fill about 245 million of the total 258 million barrels of Phase I storage capacity. A total of about 223 million barrels of oil were in storage as of that date. (App. III provides additional information on the volume of oil in SPR facilities.) The remaining Phase I capacity that is not available for storage at this time is a 13 million barrel Sulphur Mines cavern which was discussed in chapter 2.

Phase II involves creating and filling a total of 29 new storage caverns, each with a 10 million barrel capacity, by October 1987. Twelve new caverns will be created at Bryan Mound, 16 at West Hackberry, and 1 at Bayou Choctaw. Phase II leaching began in March 1980 and, as of December 1981, has created about 44 million barrels of cavern capacity which allowed DOE to store about 7 million barrels of oil. The first Phase II cavern is scheduled to be completed in December 1982. As of December 1, 1981, DOE's operations, maintenance, and leaching contractor, Dravo Utility Constructors, Inc., (DUCI) had leached about 34 million barrels of Phase II capacity at Bryan Mound and 10 million barrels of Phase II capacity at West Hackberry. Leaching at Bayou Choctaw is expected to begin by May 1982.

DUCI's contract expires January 17, 1982, and a new contractor will assume responsibility for operating, maintaining, and expanding SPR facilities. As of December 1, 1981, DOE had completed evaluating proposals for the new contract from eight companies and had selected Petroleum Operations and Support Services, Inc., of Houston, Texas, to replace DUCI. The final terms of the new contract are being negotiated. DOE officials expect to finalize the new contract before DUCI's contract expires and to make a transition to the new contractor without affecting Phase II activities. It is too early to tell how the change in contractors will affect the rate at which Phase II caverns are leached.

According to DOE's July 1981 expansion schedule, it plans to have 267 million barrels of capacity available for oil fill by the end of fiscal year 1982. This would allow a fill of about 68 million barrels or an average of about 186,000 barrels per day during fiscal year 1982--far short of the fiscal year 1981 average 292,000-barrels-per-day rate. It also represents the smallest increase in capacity for any fiscal year on the schedule--a 22 million barrel increase over capacity which was available for fill as of December 1, 1981. This compares with an average 69 million barrels of capacity to be added in succeeding years. Therefore, if the schedule is to be met, it will most likely be met in fiscal year 1982.

DOE officials believe that the expansion schedule is conservative. However, DOE has experienced delays in preparing caverns for oil fill, which we documented during the last year, and has recently experienced leaching problems at both Bryan Mound and West Hackberry, which are discussed in more detail in the following sections. Further, it is uncertain what effect a change in contractors will have on the schedule. If leaching problems continue or new problems arise in bringing a new contractor on board, DOE's schedule could be adversely affected.

Table 2 provides additional information on DOE's expansion goals for fiscal years 1982 through 1989 and the corresponding maximum oil fill rate which would be allowed by expansion plans. Between October 1, 1981, and September 30, 1989, DOE will be able to achieve an average fill rate of 189,000 barrels per day under its current expansion plan. The rate that DOE will be able to receive oil during each fiscal year varies from a low of 107,000 barrels per day in fiscal year 1985 to a high of 225,000 barrels per day in fiscal year 1986. DOE's oil fill capability during each year varies because of the number of Phase II and Phase III caverns in different stages of leaching during each fiscal year.

Bryan Mound status

As stated earlier, the rate of brine disposal affects the leaching rate. At Bryan Mound, DOE initially acquired 19 raw water and brine disposal pumps to leach at an average rate of 680,000 barrels per day. During fiscal year 1981, DOE requested and received approval from the Environmental Protection Agency and Texas to increase the average brine disposal rate at Bryan Mound from 680,000 barrels per day to 980,000 barrels per day.

Table 2

DOE Expansion Goals and Fill Based on July 1981 Expansion Schedule

Fiscal year	Storage capacity available at end of fiscal year	Annual daily oil fill rate during fiscal year
	(millions of barrels)	
1982	267	a/ 186,000
1983	343	208,000
1984	417	203,000
1985	456	107,000
1986	538	225,000
1987	611	200,000
1988	670	162,000
1989	750	219,000
Average		189,000

a/GAO calculation based on DOE's goal of filling 267 million barrels of available storage capacity by the end of fiscal year 1982.

Source: SPR Acceleration Report to the Secretary, July 1981, Strategic Planning and Analysis Division, SPR Office.

By January 1, 1982, DOE expects to have 9 additional pumps installed at the site and to begin leaching at the higher rate.

However, since July 1980, DOE has experienced problems with its 15-mile brine disposal pipeline to the Gulf of Mexico which, if not corrected, could prevent DOE from attaining the full leaching rate of 980,000 barrels per day. The problem involves excessive resistance to brine flowing through the pipeline. Normally, as brine moves through the pipeline toward the Gulf of Mexico, away from the pumps at the site, the pressure of brine within the pipeline decreases. DOE estimates that at a flow rate of 680,000 barrels per day the pressure should drop by about 130 pounds per square inch. Between March 1981 and August 1981, DOE's contractor, Jacobs/D'Appolonia Engineers, tested the pressure at three locations along the pipeline and measured an additional unexplained 40 pounds per square inch pressure drop, but has not identified the location or cause of the problem.

According to DOE officials, the pressure problem indicates brine is not flowing freely at one or more points within the pipeline. Based on the contractor's August 1981 report, DOE estimates that until the problem is solved, even with the additional pumps it plans to have operational by January 1982, DOE will be able to achieve an average of only 900,000 barrels per day. DOE's Phase II expansion schedule, however, is contingent, among other things, on achieving a 980,000-barrels-per-day brine disposal rate at Bryan Mound.

DOE project officials are now considering cutting and examining sections of the pipeline to understand and identify a solution to the problem. However, this is only the first step to solving the problem and it is uncertain when DOE will achieve the 980,000-barrels-per-day brine disposal rate.

West Hackberry status

At West Hackberry, DOE acquired 42 water and brine disposal pumps to leach new caverns and built a 27-mile brine disposal pipeline to the Gulf. According to DOE, the pumps and the pipeline will allow a 1.1-million-barrels-per-day disposal rate. DOE started leaching four of the eight Phase II caverns between May 27, 1981, and June 2, 1981. A fifth cavern was started on July 24, 1981. As of December 1, 1981, leaching of the remaining three caverns had not started.

DOE has also encountered problems in its leaching of Phase II caverns at West Hackberry which have prevented it from starting to leach the remaining three of eight Phase II caverns or from achieving a 1.1-million-barrels-per-day brine disposal rate on the five active caverns. Prior to August 23, 1981, incorrect installation of electric equipment needed to operate the site's water and brine disposal pumps limited the leaching rate at the site to about 465,000 barrels per day.

On August 23, 1981, DOE stopped leaching for about 10 days to correct the electrical problem. When leaching resumed, DOE found that wells associated with four of the five caverns had become plugged with insoluble minerals. Wells for the four caverns were unplugged during September and October 1981, and leaching resumed.

During November 1981, the brine disposal rate at the site averaged about 522,000 barrels per day because of problems DOE was experiencing in disposing of the insoluble minerals. DOE will limit leaching to this rate until January 1982 when it expects to complete construction of additional storage ponds for the minerals. DOE expects that it will then be able to increase the disposal rate to 1.1 million barrels per day.

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If the problems discussed above continue at Bryan Mound and West Hackberry and/or start-up problems occur with the new contractor, they could affect DOE's ability to achieve its Phase II expansion schedule and the fill rates which are dependent on achieving the schedule. While achieving the fiscal year 1982 expansion schedule may not be as difficult because of the lower expectations for capacity additions, problems which are not solved or new problems which arise could affect DOE's overall ability to meet its expansion schedule. If so, the fill rates shown would not be achieved unless other actions are taken. Options for increasing the fill rates are discussed on pages 25 to 31.

STATUS OF PHASE III EXPANSION ACTIVITIES

DOE's Phase III plans involve acquiring and developing a completely new 140 million barrel site and expanding capacity by 30 million barrels at West Hackberry and 40 million barrels at Bryan Mound.

Developing a completely new SPR storage site, such as the planned 140 million barrel site, tentatively selected at Big Hill, Texas, involves environmental analysis, engineering design, and construction activities. The required actions are

--performing environmental impact assessments required by the National Environmental Policy Act of 1969;

--obtaining environmental and construction permits to build oil fill and brine disposal pipelines at the site and to operate the site;

--acquiring land for the site, a brine disposal pipeline, and an oil fill pipeline;

--procuring well casing, pumps, drilling equipment, and pipelines; and

- --drilling wells; installing water, brine, and oil pipelines; leaching caverns; and filling with oil.

These actions, while required for a new site, are not all required for expansion of existing sites. At West Hackberry, DOE will need to acquire some additional land before it can begin leaching, but it will not need to build additional oil fill and brine disposal pipelines. At Bryan Mound, DOE can begin Phase III by obtaining well drilling equipment, since it does not need to acquire additional land.

Phase III funding requirements

DOE's Phase III expansion would be a major additional cost for the program. In its March 1981 budget for fiscal year 1982, DOE estimated that it will cost about $1 billion to develop the 210 million barrel Phase III storage capacity. This compares with DOE estimated costs of about $1.6 billion for both Phases I and II. According to DOE officials, the cost estimate for Phase III activities is proportionately higher than the estimate for Phases I and II because of the effects of a 10-percent inflation rate compounded each year through 1989.

DOE's fiscal year 1982 appropriation legislation provides about $99 million for Phase III to continue design, begin land acquisition, and acquire drilling equipment. Further development of Phase III sites will require continued funding in fiscal year 1983 and subsequent years. DOE's ability to meet its Phase III expansion schedule is dependent, in part, on the amount the administration decides to request for such activities in the fiscal year 1983 budget.

DOE's current Phase III schedule for existing sites

Assuming fiscal years 1982 and 1983 funding for well drilling at Bryan Mound and land acquisition at West Hackberry, DOE's current Phase III schedule for these sites is as follows:

	Leach		Fill	
	Start	Finish	Start	Finish
Bryan Mound	Sept. 1983	Feb. 1986	Sept. 1984	Oct. 1986
West Hackberry	Aug. 1984	Sept. 1987	Aug. 1985	Mar. 1988

DOE officials believe the above dates are achievable at these sites because major construction is not involved, and land acquisition is required only at West Hackberry. However, as stated earlier, DOE is experiencing numerous problems with Phase II leaching at these sites, and similar or new problems could also affect DOE's ability to meet its Phase III schedule.

New storage site development

Environmental analysis and permits, land acquisition, design, and major construction are needed if the proposed Big Hill site is to be added to the SPR. Table 3 shows DOE's proposed schedule for developing the site assuming continued funding for these activities.

Table 3

Big Hill Project Summary Schedule

	Start	Completion
Planning		
Environmental Impact Statement	Oct. 1980	Nov. 1981
Permits	-	Oct. 1984
Land Acquisition		
Site	Oct. 1981	Oct. 1982
Pipeline	-	Apr. 1984
Detail Design	Sept. 1981	May 1983
Construction	Oct. 1982	Oct. 1985
Leaching	Oct. 1985	Feb. 1989
Oil Fill	Nov. 1986	Oct. 1989

Source: DOE's July 1981 Phase III expansion schedule.

During July 1981, DOE's Energy System Acquisition Advisory Board approved procurement of pumps, pipeline, and other equipment associated with the site, contingent upon completion and approval of an environmental impact statement. This statement was published during October 1981. An architectural/engineering contract was awarded in September 1981. However, major capital commitments, such as land acquisition, have not yet been made.

According to DOE's July 1981 schedule for developing the site, land acquisition is to be completed in October 1982. Oil fill at the site is to begin during November 1986. The project schedule indicates that the January 1983 target date for drilling wells at the site and the October 1985 target date for leaching are critical to meet this oil fill date.

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DOE is conducting a study required by the Omnibus Budget Reconciliation Act of 1981 to assess the costs and benefits of the currently planned 750-million-barrel SPR and any other larger or smaller final storage capacities which might be appropriate. DOE is evaluating storage capacity levels ranging from 580 million to 1.25 billion barrels. However, this study is scheduled to be completed in February 1982 after the administration submits its fiscal year 1983 budget request. Thus, any revisions to DOE's Phase III plans that might be proposed in the fiscal year 1983 budget were developed without benefit of any completed analysis.

OPTIONS FOR ACCELERATING SPR EXPANSION

Under its current plans for Phase II and Phase III expansion, DOE will not be able to fill the SPR at the 300,000-barrels-per-day rate goal set forth in the Omnibus Budget Reconciliation Act of 1981 during fiscal year 1982 or any of the succeeding fiscal years before a 750-million-barrel SPR is filled. In July 1981, DOE completed an assessment of alternative approaches to increase its capacity to receive oil during the 1980s. The options included in this study each affect, to varying degrees, the size and cost of the SPR. Key assumptions of the study are that Phase II and III activities to create a 750-million-barrel reserve will be completed as currently planned, by the end of fiscal year 1989, and that activities to provide additional capacity would begin on October 1, 1981. The study did not assess options for filling a smaller reserve at the 300,000-barrels-per-day rate nor other options, such as leasing existing temporary storage capacity.

While we did not assess during this review what the final size nor the optimum fill rate of the SPR should be, in June 1979 1/ we pointed out that a number of factors need to be considered in determining the appropriate size of the reserve. These factors include future domestic oil supplies and demand for foreign oil, the magnitude and duration of a potential interruption in foreign oil supplies, and the effectiveness of other programs or activities which could serve to mitigate the impact of an interruption. The June 1979 report and a September 1981 report 2/ note that actions such as fuel switching, drawdown of industry supplies, demand restraint, and increase in domestic production could be used to supplement the SPR. Our September 1981 report concluded that the administration has not developed effective programs or policies in these areas to supplement the SPR and counteract the effects of a supply interruption.

The Omnibus Budget Reconciliation Act of 1981, which established the 300,000-barrels-per-day fill rate goal, authorized $60 million more for program planning, management, and facilities development than the $199 million requested by DOE for these activities during fiscal year 1982. DOE's request was based on

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1/"Factors Influencing the Size of the U.S. Strategic Petroleum Reserve" (ID-79-8, June 15, 1979).

2/"United States Remains Unprepared for Oil Import Disruptions" (EMD-81-117, Sept. 29, 1981).

its budgeted fill rate of 230,000 barrels per day. According to the Conference Report on the act, the additional authorization was to assure that sufficient funds would be available to accelerate acquisition and construction of storage capacity. However, no further information was provided concerning the use of these funds. Currently, it does not appear that DOE will receive even the funds requested to support its expansion plans. DOE's fiscal year 1982 appropriation under the Department of the Interior and Related Agencies Appropriation Act of 1981 provides 4 percent less than the $199 million requested. According to DOE officials, additional funds would be needed to build or lease storage capacity in addition to that currently planned during fiscal year 1982 and subsequent years. However, as discussed later in this chapter, DOE has not fully assessed alternatives to its current expansion plans.

DOE officials believe accelerating Phase II and Phase III is not a viable option

DOE's current Phase II and Phase III expansion plans come closest to a 300,000-barrels-per-day rate during fiscal year 1986, when DOE hopes to be able to receive about 82 million barrels of oil and achieve an average fill rate of 225,000 barrels per day. However, in previous and succeeding years, adequate new capacity will not be available to allow an average fill rate even as high as 225,000 barrels per day. Between fiscal years 1982 through 1989, current plans would allow DOE to achieve an average annual fill rate of 189,000 barrels per day.

DOE's July 1981 study states that DOE's schedule for a 750-million-barrel reserve cannot be accelerated to any significant degree. During our review, we asked DOE officials for additional information concerning the benefits and costs of accelerating Phase II and Phase III activities at Bryan Mound, West Hackberry, and the proposed Big Hill site.

According to DOE officials, to accelerate leaching at Bryan Mound and West Hackberry, an additional brine disposal pipeline would need to be built at each site. To build the new pipelines, DOE would need to conduct environmental impact studies, obtain permits, acquire additional rights-of-way, award contracts for construction and equipment, and increase the electricity available to each site. Based on the time required to build similar pipelines, DOE officials estimate these activities would take 4 to 5 years and cost about $200 million. These estimates were not documented and we were not able to verify the time or costs. If DOE were able to initiate these activities on October 1, 1982, and complete them in 4 years, DOE would be able to increase its leaching rate on October 1, 1986. However, according to DOE's schedule, leaching at Bryan Mound will be completed in February 1986. Although leaching at West Hackberry is scheduled to be completed in September 1987, the increased leaching capacity would only enable DOE to increase its oil storage capacity at the site by 12 million barrels for fiscal year 1987. However, even this additional capacity would only allow DOE to increase its fill rate by about 33,000 barrels per day over the currently planned 200,000-barrels-per-day fiscal year 1987 fill rate. The total rate of 233,000 barrels per day still would be less than the suggested rate.

If the acceleration efforts took 5 years, DOE would be able to increase its leaching rate on October 1, 1987. However, if DOE adheres to its current expansion schedule, as noted above, it would have completed Phase II and Phase III leaching at both sites by September 1987. Thus, the additional pipelines would not be available in time to increase capacity substantially before the planned capacity at the sites is completed.

To accelerate development of the 140 million barrel Big Hill site planned for Phase III, DOE would have to accelerate acquisition of land for the site, drilling of wells, and the start of leaching at the site. DOE officials believe that acquiring land sooner than the October 1982 target date would involve land condemnations without preliminary negotiations to buy the land. If land acquisition were accelerated, DOE would also have to award a drilling contract during fiscal year 1982 to accelerate drilling at the site. DOE's plans now call for awarding the contract during October 1982 using fiscal year 1983 funds. DOE's fiscal year 1982 budget request included $103 million for Phase III to continue design, begin land acquisition, and acquire drilling equipment. DOE's fiscal year 1982 appropriation legislation provides about $99 million for these activities. Since funds to award a drilling contract were not included in the fiscal year 1982 budget request or appropriation legislation, DOE would need to request a supplemental appropriation or request approval to reprogram existing funds. DOE officials indicated they would need an additional $100 million in fiscal year 1982 funds to award a drilling contract during the fiscal year. Even if the Congress approves a supplemental appropriation or reprogramming of funds, it is unlikely that DOE would be able to advertise for bids and award a drilling contract more than a month or two before its currently planned October 1982 award date.

DOE options to accelerate SPR capacity

Table 4 shows the cost and projected storage capacity for DOE's planned 750-million-barrel SPR, and four alternative approaches discussed in its July 1981 report, on accelerating the availability of SPR storage capacity. Four of the five options discussed in the report involve increasing the size of the SPR above the 750-million-barrel capacity of Option 1, DOE's currently planned capacity. The schedules presented in the report assume that expansion activities start on October 1, 1981. Since this date has passed and the expansion activities have not

Table 4

DOE's Estimated Cost and Storage Capacity

Available Under SPR Expansion Options

Options	Cost			Available storage capacity at end of fiscal year (note a/)						Equivalent average annual fill rate for fiscal years 1982 through 1989
	Facilities	Oil	Total	1984	1985	1986	1987	1988	1989	
	- - - - - - -(billions) - - - -			- - - - - (millions of barrels) - - - -						- -(barrels per day)- -
1. DOE's Planned 750 million barrel system	$3.1	$37.4	$40.5	417	456	538	611	670	750	189,000
2. 790 million barrel system (Option 1 plus 40 million barrel Cote Blanche site)	3.3	39.5	42.8	435	496	578	651	710	790	202,000
3. 890 million barrel system (Option 2 plus 100 million barrels in steel tanks)	4.7	45.7	50.4	435	520	638	743	810	890	237,000
4. 1 billion barrel system (Option 3 plus 110 million barrel underground site)	5.7	54.1	59.8	435	520	638	743	824	b/950	257,000
5. 1 billion barrel system (Option 3 plus 110 million additional steel tank capacity)	6.2	53.0	59.2	435	520	662	803	904	1000	274,000

a/Storage capacity available at the end of fiscal year 1982 and 1983 are 267 million and 343 million barrels respectively under each option.

b/Storage capacity under this option would reach 1 billion barrels during fiscal year 1990.

Source: DOE's July 1981 SPR Acceleration Report to the Secretary of Energy.

been initiated, additions to capacity and fill rates will differ
As noted earlier, each option also assumes that DOE adheres to its schedule for completing a 750-million-barrel reserve.

Option 1, as noted, involves DOE's current schedules for completing the planned 750 million barrels of capacity. Under this option, the annual fill rate would average about 189,000 barrels per day until total capacity is reached in fiscal year 1989.

Option 2 consists of completing the currently planned 750-million-barrel capacity and acquiring another 40 million barrels of capacity at Cote Blanche, Louisiana, for a total capacity of 790 million barrels. Cote Blanche is an operating salt mine which DOE identified during the early stages of the program and considered during 1978 to 1979. DOE officials stated that DOE did not pursue acquiring the Cote Blanche site at that time because it suspended oil purchases in early 1979 and it was uncertain of the future availability of oil. Since DOE prepared an environmental impact study for this site as part of the previous assessment, and leaching is not necessary in a salt mine, 40 million barrels of additional capacity could be available in less time at Cote Blanche than at any other site considered. Increasing SPR capacity to 790 million barrels under this option would enable DOE to maintain an average fill rate of about 202,000 barrels per day through fiscal year 1989.

Option 3 involves adding the 40 million barrel Cote Blanche site to the currently planned capacity plus constructing 100 million barrels of above-ground steel tank capacity to achieve 890 million barrels of total capacity. Under this option, DOE would acquire three sites and construct steel tanks with 40 million barrels of capacity at one site and 30 million barrels at each of the two other sites. Undertaking this option would enable DOE to exceed the 300,000-barrels-per-day fill rate in fiscal year 1986 by filling at a rate of 323,000 barrels per day during the year. The average annual fill rate would increase to about 237,000 barrels per day through fiscal year 1989 under this option.

Option 4 consists of developing the capacity called for under Option 3 plus acquiring another site and developing additional underground storage caverns for about 110 million barrels of oil. This option would increase total SPR storage capacity to about 1 million barrels by fiscal year 1990. As with Option 3, this option enables DOE to reach a fill rate of 323,000 barrels per day in fiscal year 1986. It also allows DOE to fill at about 345,000 barrels per day in fiscal year 1989. DOE's fill rate would average about 257,000 barrels per day through fiscal year 1989 under this option.

Option 5 also involves developing the capacity called for under Option 3 but adds 110 million barrels of capacity through the construction of additional above-ground steel tanks. In addition to the sites that DOE would need to acquire for the capacity associated with Option 3, this option would involve acquiring three more sites--two with 40 million barrels and one with 30 million barrels of capacity. This option would increase total SPR capacity to 1 billion barrels and enable DOE to exceed the 300,000-barrels-per-day fill rate in fiscal years 1986 and 1987 by averaging 389,000 and 387,000 barrels per day, respectively. DOE would be able to maintain an average annual fill rate of 274,000 barrels per day through fiscal year 1989 under this option.

A comparison of the capacity available under Options 4 and 5 shows that while capacity can be increased faster by constructing steel tanks than by developing a comparablely sized underground site, the underground site would cost less. However, it does not show the comparative costs and benefits of substituting above-ground steel tanks for some portion of the currently planned 750-million-barrel SPR or a reduced SPR size.

Effects of DOE options on SPR costs

Each of the options considered in DOE's July report would increase the cost of the SPR. As shown in table 4, developing the additional storage capacity associated with these options would increase SPR facilities' costs by $200 million under Option 2 to $3.3 billion. Under Option 5, facilities' costs would increase to about $6.2 billion which is double the cost of facilities for a 750-million-barrel reserve. Since Options 2 through 5 increase the size of the SPR, the additional oil required would increase costs by $2.1 billion under Option 2 to $16.7 billion under Option 4. Although Options 4 and 5 both call for 1 billion barrels of oil, Option 4 would be completed 1 year later, and DOE estimates that because of differences in the scheduled availability of storage capacity, the oil acquired under Option 4 would cost $1.1 billion more than the oil acquired under Option 5.

Additional option of leasing SPR storage space

DOE also may be able to lease existing storage capacity to increase the SPR's oil fill capability while long-term storage capacity is being developed. Existing capacity may be available in the form of above-ground steel tanks, underground caverns, or tankers. Although DOE discussed leasing storage space with several companies during the fall of 1981, DOE has not developed plans for leasing because it intends to fill the SPR at the average 189,000-barrels-per-day rate allowed for in current capacity expansion plans. DOE has not documented the costs and benefits of leasing additional storage space. However, DOE officials said that they are generally aware of the availability and cost of leasing storage space through informal contacts with industry. The DOE officials believe that DOE could lease between 10 million and 30 million barrels of capacity at a monthly cost of about 15 cents per barrel.

Based on the current expansion schedule for the 750-million-barrel reserve, DOE would need to lease from 42 million barrels in fiscal year 1982 to a maximum of 208 million barrels in fiscal year 1986 to fill the SPR at an average rate of 300,000 barrels per day. DOE officials expressed concern that, based on a 1979 National Petroleum Council report on "Petroleum Storage and Transportation Capacity", this volume of storage may not be available for leasing. The 1979 report stated that, as of September 30, 1978, no significant capacity existed in the petroleum industry's primary tanks and pipelines to hold emergency supplies of oil. However, we note that the statistics cited may not be relevant today. Because of time constraints of this review, we did not attempt to determine the volume of storage capacity that may be available for SPR leasing as of December 1, 1981.

CONCLUSIONS

During fiscal year 1981, availability of SPR storage capacity, oil acquisition funds, and oil supplies contributed to DOE's achievement of an average fill rate of 292,000 barrels per day. Under current plans, during the remainder of the 1980s, at best DOE will be able to achieve an average fill rate of 189,000 barrels per day. This assumes that DOE maintains its schedule for completing a 750-million-barrel SPR in 1989 and that funds are available to fill storage capacity as it becomes available.

It is too early to tell whether, during the next 8 years, DOE will maintain its 750-million-barrel expansion schedule. If current problems continue or additional problems arise so that DOE does not adhere to its expansion schedule, the average fill rate during fiscal years 1982 through 1989 will be less than the 189,000 barrels per day now planned. According to DOE officials, current Phase II and Phase III expansion plans cannot be reasonably accelerated because of key factors such as brine disposal rates and lead time requirements for land acquisition and major construction.

Although the 189,000 barrels-per-day rate exceeds the minimum fill rate requirement in the Energy Security Act, it will not meet the 300,000-barrels-per-day fill rate goal set forth in the Omnibus Budget Reconciliation Act. The only options DOE considered to achieve an average fill rate approaching 300,000 barrels per day each involve a decision to increase the size of the SPR. While DOE has taken action since our February 1981 report to increase the brine disposal rate at Bryan Mound, which would allow faster leaching at that site and has studied some options for further increasing the fill rate, DOE's actions have not ensured that adequate capacity will be available on a timely basis to meet the needs of an accelerated 300,000-barrels-per-day fill effort. Further, DOE's most recent efforts to analyze the costs, advantages, and disadvantages of an accelerated construction program assumed its current construction schedule and considered only those options which increase the size of the reserve. It does not fully satisfy our earlier recommendation to report to the Congress on the costs, advantages, and disadvantages of an accelerated construction program and other storage options in part because it did not include a consideration of leasing temporary storage space. It also did not consider the costs and benefits of substituting above-ground steel tanks for some portion of the currently planned 750-million-barrel SPR or a reduced SPR size.

DOE may be able to lease existing storage space which could be used in combination with, or in place of, additional construction activities to supplement SPR storage capacity. DOE could purchase oil and fill leased storage space during the early 1980s and use this oil to fill the SPR during the late 1980s. DOE has discussed leasing space for temporary oil storage with several companies. However, it has not developed plans for leasing nor documented the costs and benefits of leasing because it intends to fill the SPR at the rate allowed by current expansion plans. DOE has not surveyed the extent of temporary storage which might be available.

If DOE is to ensure that adequate capacity is available on a timely basis consistent with congressional fill rate goals, it must have sufficient funds and an appropriate plan to provide the capacity needed. Depending on the size of the reserve, the desired fill rate, and funds provided through the congressional budget process, DOE may need to alter its current capacity expansion plans.

To assist the Congress in its deliberations over appropriate SPR funding levels, DOE should more fully assess the costs and benefits of alternatives to its current expansion plans which achieve an average fill rate of 300,000 barrels per day. This assessment should be made available to the Congress for its fiscal year 1983 budget deliberations. Based on further DOE assessment of options for achieving a 300,000-barrels-per-day fill rate and on the matters discussed in this report, the Congress may wish to reaffirm or provide new guidance on its desired SPR fill rate.

RECOMMENDATION

We recommend that the Secretary of Energy:

--Evaluate options for achieving an average annual fill rate of 300,000 barrels per day assuming the planned and other SPR sizes. The evaluation, which should be available for fiscal year 1983 congressional budget deliberations, should assess costs and benefits of alternatives to constructing new underground storage facilities, including such options as leasing temporary storage capacity.

MATTERS FOR CONSIDERATION BY THE CONGRESS

As part of the fiscal year 1983 budget process, the Congress should explore with the Department of Energy the matters discussed in this report regarding its current capacity expansion plans and options to achieve an average fill rate of 300,000 barrels per day until the SPR is filled. Based on its evaluation, the Congress should reaffirm or provide new guidance on its desired SPR fill rate.

CHAPTER 4

DOE PURCHASES HEAVIER CRUDES

The first oil acquisition plan and specifications for SPR crude oil quality were established in 1976. While many minor modifications were made within types of acceptable oils, the overall oil acquisition plan and quality specifications remained close to the original specifications during the first 4 years of the program. However, in October 1980 and in August 1981, DOE allowed the acquisition of substantial quantities of heavier crude oils.

This chapter discusses

--the rationale for the oil acquisition plan and 1976 specifications for SPR crude oil quality and

--two changes to the overall acquisition plan during fiscal year 1981 to accept heavier crudes.

BACKGROUND

In the event of a drawdown, SPR crude oil must be refined into petroleum products before it is used by consumers. U.S. refineries can produce a range of products, such as gasoline, kerosene and jet fuels, heating oil, lubricants, waxes, asphalt, and coke in descending order from lightest to heaviest. The proportion of these products varies with refinery design, market demand, and with the physical characteristics, or quality, of the crude oil used. The quality of the SPR oil, therefore, is an important determinant of the amount of specific petroleum products available to the Nation during an interruption.

The SPR oil quality can also affect which refiners would be able to use the oil. A refinery designed only to process light crude oil may not be able to refine the heavier SPR oil, unless sufficient supplies of light crude were available for blending. However, refineries designed to process heavier oil would have little difficulty refining either the light or heavy crude oil distributed from the SPR. In fact, if these refineries processed the light SPR oil, the more severe processing activities within some refineries, such as catalytic cracking, would result in a larger product yield of the lighter products, such as gasoline.

A 1980 National Petroleum Council report estimated that by 1982 only about 24 percent of U.S. refinery capacity will be devoted to processing heavy, medium- and high-sulfur crudes, 1/

1/The report defines heavy, medium-sulfur crude as having greater that 15 percent residuum assay at 1,050 degrees Fahrenheit and a total sulfur content of greater than 0.5 percent of weight.

including Alaskan North Slope (ANS) oil. Although the trend in refining capacity is moving toward processing more heavier, high-sulfur oils, the current ability of U.S. refineries to process the heavier crude oil now being purchased for the SPR is limited.

RATIONALE FOR 1976 SPR QUALITY SPECIFICATIONS

A 1976 report, prepared for the Federal Energy Administration (FEA), 1/ has formed the basis for the SPR oil quality specifications and the oil acquisition plan. The report surveyed about 80 types of crude available throughout the world. It assessed 1974 U.S. refinery capabilities and product demand and projected 1980 U.S. refining capabilities and product demand. The objective of the study was to determine the types of oil which, if stored in the SPR, would allow refiners to produce the same volume and mix of petroleum products during a hypothetical 1980 oil supply interruption as they would without the interruption.

The report grouped 23 major crude sources into six broad types that were acceptable for the SPR. The specifications for the six oil types, as modified slightly by FEA and DOE based on the changing status of oil availability, are shown in table 5. Overall, however, the six major types remained essentially intact. In addition, the report listed the quality characteristics of about 30 crudes which were unacceptable for the SPR. Among the reasons given were excessive high-sulfur content and residual yield, high oil viscosity, and limited availability of oil.

The Turner, Mason, and Solomon report used a refinery model to determine that a combination of two of the six types of crude--67 percent of Type I (intermediate gravity, high-sulfur oil) and 33 percent Type II (very light, low-sulfur oil)--would allow the SPR to respond to the supply interruption. The two crude oil types represented a trade-off between refinery needs and SPR crude oil acquisition costs. The study also indicated that during an interruption, if an emphasis were placed on production of distillate and residual fuel oil at the expense of lighter products such as motor gasoline, the preferred SPR crude oil quality mix would be 90 percent Type I and only 10 percent Type II. The study stated that this type of yield structure might be used if an interruption response strategy involved a severe limitation of gasoline usage through rationing.

In December 1976, FEA issued its SPR plan, which established the six acceptable crude types discussed above and a strategy specifying the mix of crudes to be purchased. FEA decided that about 60 percent of the crude oil to be stored in the SPR would

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1/Turner, Mason, and Solomon Consulting Engineers, "Composition of SPR Crude Oil Initial Analysis," prepared for FEA, Oct. 11, 1976.

Table 5

Quality Specifications and Yields of the Six Types of Crude Oil

Acceptable for the SPR as of December 1, 1981 (note a)

Criteria	Type I intermediate, high-sulfur	Type II very light, low-sulfur, low mercaptan	Type III intermediate, low-sulfur, low mercaptan	Type IV light, low-sulfur, low mercaptan	Type V light, low-sulfur, high mercaptan	Type VI intermediate, intermediate-sulfur
API gravity ($^{\circ}$API)	30° - 36°	40° - 45°	30° - 36°	34° - 40°	36° - 41°	26° - 30°
Total sulfur content (% of weight)	1.99 max.	0.25 max.	0.50 max.	0.25 max.	0.50 max.	1.25 max.
Viscosity (note b)	150 max.	150 max.	150 max.	150 max.	150 max.	200 max.
Mercaptan (note c)	no limit	12 max.	12 max.	12 max.	No limit	No limit
Refinery yields (%)						
Naphtha	24 - 30	35 - 42	21 - 29	29 - 36	30 - 38	15 - 20
Distillate	17 - 31	21 - 35	23 - 37	31 - 45	19 - 33	24 - 27
Gas Oil	26 - 38	20 - 34	28 - 42	20 - 34	23 - 37	38 - 42
Residuals	10 - 19	4 - 9	7 - 14	0 - 5	7 - 14	15 - 20

a/Current quality specifications and yields reflect modifications to the 1976 FEA plan so that additional sources of oil, such as ANS and an Ecuadorian crude known as Oriente, and blends, would be acceptable for the SPR. For example, the lower limit of API gravity was reduced by 1 degree to 2 degrees for Types I, II, and VI and by 4 degrees for Type V; however, the lower limit was raised 1 degree for Type III (from 29 degrees to 30 degrees). The effect of the modifications to the quality specifications is to slightly reduce the acceptable refinery yields of naphtha, distillates, and gas oil.

b/Measures how much energy is needed to move a fluid. Generally, the higher the viscosity of the oil, the more energy is needed to move it through a pipeline.

c/Measures sulfur compounds in parts per million at 375 degrees to 500 degrees Fahrenheit.

Source: DFSC's January 1981 open continuous solicitation.

be Type I and 40 percent would be Types II, III, and IV oils (Types II, III, and IV are low-sulfur; however, Types III and IV although intermediate to light oils, are heavier oils than Type II oils.) Type V (high-quality oil, but the Turner report only identified two U.S. and one Libyan source of supply) and Type VI (lower sulfur, but heavier crude than Type I) were not included in its acquisition plan.

FEA stated in its 1976 plan that these crude oil specifications were selected to permit the SPR to provide replacement crude oil that would be acceptable to any refinery affected by an oil interruption. According to the FEA plan, only low-sulfur crude oil was acceptable to all refiners. However, because industry uses some products, such as fuel oil, which can have a high-sulfur content, a refinery would be processing better and, according to the plan, more expensive crude oil during an interruption than was needed to meet product specifications. FEA decided to store Type I crude oil in the SPR to reduce the cost of acquiring oil for the SPR, while still providing oils which refiners could use. FEA stated, however, that final decisions concerning the types of oil stored in the SPR would be affected by market availability and prices of the various types of crudes.

In 1978, a solicitation was issued which for the first time included Type V. DOE did not provide any documentation on the rationale for adding Type V to the acquisition strategy; however, a DOE official pointed to the availability of North Sea oil, much of which conforms to the revised Type V quality specifications. Because Type V crude is a high-quality oil, we note that it can provide a high percentage of lighter products and can be used by nearly all U.S. refineries.

DOE contract to update SPR oil quality specifications

While the 1976 SPR plan was a good first step in analyzing refinery capabilities and product needs, it is now out of date. According to DOE, since that time, many unforeseeable changes have occurred, particularly, (1) large increases in foreign crude oil prices have resulted in lower demand growth rates for most U.S. petroleum products and (2) Iran is no longer a dependable crude oil source for the Nation. These and other changes prompted DOE in May 1981 to award a $258,000 contract to William Brothers Engineering Company of Tulsa, Oklahoma, to update the 1976 study.

The objective of the study, according to the contract's statement of work, is to develop revised SPR crude oil and refined product storage mix specifications, which will form the basis for any revisions to DOE's acquisition strategy. DOE officials plan to accomplish this by having the contractor develop projections of refiners' 1985 capability to process light and heavy oils with varying sulfur contents. The contractor then will use a model to project refiners' 1985 production of petroleum products under 10 possible oil supply interruptions.

The study is scheduled to be completed in August 1982. In the meantime, DOE has made decisions to acquire lower quality oil that are not based on analyses of U.S. product needs and refinery capabilities.

OCTOBER 1980 DECISION TO ACCEPT TYPE VI CRUDES

DFSC's October 3, 1980, competitive exchange solicitation marked the first time that Type VI (26 to 30 degrees API gravity) oil was requested for the SPR. This allowed companies to offer ANS oil, which had come on-stream in June 1977, for the SPR.

As stated in our March 22, 1979, report, "Information on Department of Energy's Management of the Strategic Petroleum Reserve" (EMD-79-49), DOE did not acquire ANS oil before October 1980 because:

--The API gravity and expected refinery yields did not meet SPR specifications in use at the time (Types I through IV). ANS oil is about 26.5 degrees API gravity (about 3.5 degrees less than Type I crude) and generates less middle distillate products, such as kerosenes and jet fuels.

--A sufficient number of U.S. tankers did not exist to transport ANS oil to SPR sites. U.S. tankers have to be used to comply with the Merchant Marine Act of 1920 (P.L. 66-261), which requires that U.S. vessels be used to transport commodities between U.S. ports.

Concerning the rationale for the change in the SPR acquisition plan to include ANS crude, in October 1980, 1/ we reported that U.S. tankers were in sufficient supply and were being used to transport 500,000 barrels per day of ANS crude oil to the Gulf Coast refineries. We reported in our November 1980 status report, 2/ that the solicitation was amended because DFSC officials believed ANS crude was available on the market. Also, as stated previously, DOE had been only partially successful in meeting the minimum 100,000-barrels-per-day oil fill rate required by the Energy Security Act through its first competitive exchange solicitation. The first solicitation resulted in only 65,000 barrels per day. When DOE also allowed Type VI oil through its October 1980 supplemental solicitation, the remaining

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1/"Using Elk Hills and Alaskan North Slope Oil to Supply the Strategic Petroleum Reserve" (EMD-81-4, Oct. 21, 1980).

2/"Status of Strategic Petroleum Reserve Activities--October 1980" (EMD-81-24, Nov. 3, 1980)

35,000 barrels per day were achieved. Of this amount, 5.4 million barrels, or about 15,000 barrels per day, consisted of ANS oil.

The only documentation DOE provided us on the capability of refiners to process ANS oil was a DOE staff memorandum for the record dated October 3, 1980. The memo presents the staff's efforts to analyze the implications of storing ANS oil, and DOE officials said that it provides support for the purchase of ANS oil for the SPR. The memo stated that most refineries would have to blend ANS crude with other crudes before it could be satisfactorily processed. However, it also states that "* * * industry facing a crude shortage would take any crudes that the SPR could issue and effectively utilize them to make specific product slates." The memorandum gives some limited regional data on existing capacity and expansion plans; however, these data are insufficient to substantiate its claim that industry could effectively utilize ANS oil to yield specified product slates. Overall, the memo does not provide a sufficient analytical basis to justify changing the oil acquisition strategy.

Regarding product yields, the memorandum states that unblended ANS oil will yield a greater percentage of gasoline than Type I crude oils. The memo notes, however, that residual components would increase, and distillate fractions used for blending commercial jet fuels would substantially decrease.

We discussed ANS product yields with three refining industry officials. They stated that gasoline yields could be increased by processing naphtha and gas oils. However, they stated that to obtain gasoline from gas oil would require catalytic cracking equipment. Further, they believe that, given current capabilities, refineries would not be able to get higher yields of gasoline from ANS oil as compared to Type I crudes, such as Arabian lights.

1981 CONTRACT WITH PEMEX--A NEW TYPE VIa

In July 1981, PEMEX offered to sell oil to the United States for the SPR. According to DFSC officials, PEMEX had recently lost customers because of its July increase in official selling price for Isthmus crude oil from $32 to $36 per barrel. Consequently, PEMEX offered to sell a blend of Isthmus, a Type I crude, and Maya, a low-quality crude, to DOE based on a selling price of $34 per barrel for the Isthmus crude.

In August 1981, a contract was signed for delivery to the SPR of 6 million barrels of Maya crude by December 31, 1981, and 104 million barrels of a blend of 60 percent Isthmus and 40 percent Maya crudes between September 1, 1981, and August 31, 1986. The 5-year contract represents the longest term commitment of oil to the SPR to date. As such, it provides a long-term supply from a secure source. DOE officials stated that, while high-quality world oil supplies have been available for much of the year, DFSC has not been successful in getting long-term contracts. As an example, they point to DFSC's announcement on December 5, 1981, that in response to its solicitation, only one of the eight offers for long-term contracts met its price standards.

The price of the oil under the PEMEX contract was set at $28.50 per barrel for Maya crude and $31.80 per barrel for the Isthmus/Maya blend. Under terms of the contract, prices can be renegotiated each quarter at DOE or PEMEX request. We did not evaluate the reasonableness of the contract prices.

The Isthmus/Maya oil blend does not completely conform to quality specifications of Type I or Type VI oils. Consequently, DOE established a new Type--VIa. Maya crude by itself does not meet any of the SPR quality specifications. (See table 6.)

The minimum API gravity for the Maya crude is 22 degrees, which indicates it is a heavier crude than that allowed by the specifications. Type VI allows a low of 26 degrees API, and Type I crudes range from 30 degrees to 36 degrees API gravity. The sulfur content of Maya is 3.5 percent, which is 1.5 percentage points greater than the highest sulfur content acceptable under the specifications. Removing the higher sulfur content requires additional processing equipment, which many U.S. refiners do not have. The viscosity, a measure of the resistance of the oil to flow, for the Maya oil is 1,500. This means that Maya crude is more than 7 times more viscous than other oil accepted by the SPR, including Types VI and VIa oils.

The PEMEX contract allows up to 50 percent of the refinery yields for Maya to be residuals, such as coke and asphalt. This is 2-1/2 times higher than the 20 percent maximum for Type VI and about 2 times higher than the 23 percent allowed under the new Type VIa established to accommodate the contract.

In fact, the Maya crude is higher in sulfur and residual yield than 9 out of 11 crudes that the 1976 Turner, Mason, and Solomon report recommended not be stored in the SPR because of excessive high-sulfur and residual yields.

DOE did not furnish us any evidence that it considered the implications of the PEMEX contract's lower oil quality specifications on the SPR's ability to supply needed petroleum products during an oil supply interruption. While DOE officials told us that they discussed technical matters concerning the handling and processing of the Maya crude with some U.S. refiners which have handled the crude, they did not provide any documentation on the extent of U.S. refiners' capabilities to handle the Maya crude or the new Type VIa quality specification.

We talked with officials at the parent companies of 9 of the 24 U.S. refineries that used all of the Maya crude that was imported between June 1980 and July 1981. They confirmed the quality and yield limitations of Maya crude. The refineries which receive Maya crude generally have equipment to process

Table 6

Comparison of Sour Oil Quality Specifications and Yields (DOE's Types I, VI, VIa, Crude Oils, and Maya Crude Oil)

	SPR Type I oil (includes Arab light oil, Mexican Isthmus oil)	SPR Type VI (includes Alaskan North Slope oil)	SPR Type VIa crude oil (blend specified in PEMEX contract)	Maya crude oil as specified in PEMEX contract
API gravity (° API)	30°-36°	26°-30°	28° min.	22° min.
Total sulfur content (% of weight)	1.99% max.	1.25% max.	1.99% max.	3.5% max.
Viscosity	150 max.	200 max.	200 max.	1,500 max.
Refinery yields				
Naphtha	24-30%	15-20%	23% min.	10% min.
Distillate	17-31%	24-27%	22% min.	15% min.
Gas Oil	26-38%	38-42%	32% max.	20% min.
Residuals	10-19%	15-20%	23% max.	50% max.

Source: DOE, "SPR Annual Report," Feb. 16, 1980 and contract with PEMEX.

low-quality oils. The officials indicated that they use Maya crude to produce residual products, such as coke and asphalt. To counter the low-gravity, high-metals content, and high-sulfur content of Maya, the refineries blend it with other crudes.

According to DOE officials, DOE agreed to accept the 6 million barrels of Maya crude as part of its contract with PEMEX in order to obtain an assured long-term supply of the Type VIa blend. DOE and DFSC officials stated that, during July and August 1981, PEMEX contracts with foreign companies generally required 50 percent of the oil delivered to be heavier Mexican crudes.

In September 1981, DFSC received an unsolicited offer to sell 1.5 million barrels of the same (60/40) blend of Isthmus/Maya crude to DFSC for the SPR at prices identical to the PEMEX contract. The offer was rejected by DFSC, based on DOE's technical evaluation. DOE officials stated that the open continuous solicitation did not include Type VIa and thus it was inappropriate to accept the offer. Further, DOE did not want to encourage more offers outside its specifications.

Changes to August 1981 contract

As discussed in our August 1981 status report, DOE officials initially expected that PEMEX would deliver a blend of 60 percent Isthmus oil and 40 percent Maya oil to meet the contract's specification for Type VIa oil. However, according to DOE officials, the 60/40 blend of Isthmus/Maya crude delivered during October 1981 did not meet the contract's specifications for the blend. As a result, DOE and PEMEX modified the contract in November 1981 to adjust the blend to 75 percent Isthmus and 25 percent Maya oil. The price of the blend was increased accordingly. The current price of $32.62 is based on the new ratio with $34 the price for Isthmus and $28.50 for Maya crude. On November 2, 1981, PEMEX increased the price for Isthmus oil from $34 to $35 per barrel. PEMEX's new price, however, does not apply to DOE's contract as currently modified.

As of December 1, 1981, DOE accepted for storage in the SPR about 1 million barrels of unblended Isthmus oil, 6.5 million barrels of unblended Maya oil, 4.5 million barrels of the 60/40 Isthmus/Maya blend, and 2.4 million barrels of the 75/25 blend for a total of about 14.4 million barrels under the PEMEX contract.

On December 11, 1981, DOE officials informed us that they have proposed a second modification to the PEMEX contract so that, after January 1, 1982, DOE will receive Isthmus and Maya oil unblended. Of the 86 million barrels scheduled to be delivered after January 1, 1982, DOE expects to receive about 65 million barrels of Isthmus and 21 million barrels of Maya crude.

In total, DOE officials expect to receive about 27 million barrels of the low-quality Maya crude and about 17 million barrels of the 60/40 and 75/25 blends of Isthmus and Maya crudes. DOE currently plans to store the Maya oil in Phase II and Phase III caverns at Bryan Mound separate from the unblended Isthmus oil delivered under the contract.

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By December 1, 1981, the SPR had received 223 million barrels of oil. Of that total, 40.3 million barrels, or 18 percent, were Types VI, VIa, or unblended Maya. In addition, on December 5, 1981, DOE awarded a contract to Atlantic Richfield Company for 2.14 million barrels of ANS oil to be delivered between April and October 1982. The extent that DOE has lowered or will lower the quality of oil for the SPR without adequate analysis will depend on future purchases, decisions on the final size of the SPR, and the results of DOE's ongoing study on the crude oil mix for the SPR.

CONCLUSIONS

While the 1976 SPR crude oil quality specifications and oil acquisition strategy were based on analysis of U.S. refiners' capabilities and product needs, 1980 and 1981 changes to the acquisition strategy and quality specifications which allowed purchase of heavier, lower quality oil, were not based on similar analysis. Although DOE awarded a $258,000 contract in May 1981 to perform such an analysis, the study will not be completed until August 1982. In the interim, DOE has continued to purchase lower quality oil without the needed analysis. The most recent example was the August 1981 PEMEX contract.

The heavier oils purchased during 1980-81, Types VI, VIa, and unblended Maya oil, currently comprise about 18 percent of the 223 million barrels in the SPR. Depending on the ultimate size of the reserve and the amount of heavier crude oil it contains, this percentage could change. Consequently, the likely impact on the mix of oil products which might be available during an oil supply interruption or on U.S. refiners' ability to process the oil is not known at this time.

RECOMMENDATIONS

We recommend that the Secretary of Energy:

- --Emphasize crude oil quality in acquiring oil for the SPR under current specifications, to the extent that availability and prices of such crudes allow.
- --Require that the Deputy Assistant Secretary for the SPR document the rationale for any future lowering of SPR oil quality specifications. Such documentation should address key reasons for the change, such as the availability and comparative costs of higher quality crude oils.

--Make a decision no later than September 30, 1982, on whether the quality specifications and acquisition strategy for SPR oil should be revised. The results of the ongoing studies of oil quality and the size of the reserve should be useful in making that determination.

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United States Senate
COMMITTEE ON
ENERGY AND NATURAL RESOURCES
WASHINGTON, D.C. 20510

July 23, 1980

Honorable Elmer B. Staats
Comptroller General of the United States
GENERAL ACCOUNTING OFFICE
441 G Street, N.W.
Washington, D. C. 20548

Dear Mr. Staats:

On June 30, 1980 the President signed the Energy Security Act (Public Law 96-294). Title VIII of this Act is intended to provide for a resumption of purchases by the United States government of crude oil for the Strategic Petroleum Reserve authorized in 1975 by the Energy Policy and Conservation Act. Purchases of oil for this purpose have been suspended for well over a year, despite the fact that the present level of the SPR is clearly inadequate insurance against any contemplated interruption in petroleum imports.

The Congress attaches a high priority to the timely implementation of the provisions of title VIII. Both the language of the Act and the accompanying joint statement of managers are very emphatic on this matter. Accordingly, we are asking that you assist Congress in monitoring implementation of this title by the Executive Branch.

In particular we request that the General Accounting Office report by letter on a monthly basis to the Senate Committee on Energy and Natural Resources and the House Committee on Interstate and Foreign Commerce describing the activities taken by the Executive Branch under the provisions of title VIII of the Energy Security Act. This report should include GAO's evaluation of these activities in relation to the clear intent of Congress, expressed in the Act, to resume as soon as possible the filling of the SPR. These monthly reports should continue through October, 1981. We are further requesting that GAO provide Congress by January 1, 1982 with a comprehensive report on activities of the Executive Branch under title VIII for the period July, 1980 through October, 1981.

Honorable Elmer B. Staats
Page Two
July 23, 1980

Please let us know if the Senate Committee on Energy and Natural Resources or the House Committee on Interstate and Foreign Commerce can be of assistance in carrying out this request.

Sincerely yours,

Harley O. Staggers
Harley O. Staggers
MEMBER OF CONGRESS

Bennett Johnston
J. Bennett Johnston
U. S. SENATOR

John D. Dingell
MEMBER OF CONGRESS

Henry M Jackson
Henry M. Jackson
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Lowell P. Weicker, Jr.
U. S. SENATOR

SPR REPORTS ISSUED BY GAO

1. "Issues Needing Attention in Developing the Strategic Petroleum Reserve" (Feb. 16, 1977, EMD-77-20).

2. "Need to Minimize Risks of Using Salt Caverns for the Strategic Petroleum Reserve" (Jan. 9, 1978, EMD-78-25).

3. "Questionable Suitability of Certain Salt Caverns and Mines for the Strategic Petroleum Reserve" (Aug. 14, 1978, EMD-78-65).

4. "Acquisition of Royalty Oil for the Strategic Petroleum Reserve" (Oct. 6, 1978, EMD-79-1).

5. "Transportation Planning for the Strategic Petroleum Reserve Should Be Improved" (Oct. 18, 1978, LCD-78-211).

6. "Failure to Develop Adequate Data for the Regional Petroleum Reserves" (Mar. 20, 1979, EMD-79-14).

7. "Information on the Department of Energy's Management of the Strategic Petroleum Reserve" (Mar. 22, 1979, EMD-79-49).

8. "DOE's Management Control Procedures for Safeguarding the Reserve" (Mar. 27, 1979, EMD-79-42).

9. "Factors Influencing the Size of the U.S. Strategic Petroleum Reserve" (June 15, 1979, ID-79-8).

10. "U.S. Strategic Petroleum Reserve at a Turning Point--Management of Cost, Oil Supply Problems, and Future Site Development" (Jan. 2, 1980, EMD-80-19).

11. "Purchase Price of Strategic Petroleum Reserve Oil Fair, but Payment Timing Is Costly" (Apr. 3, 1980, PSAD-80-30).

12. "Status of Strategic Petroleum Reserve Activities" (Sept. 23, 1980, EMD-80-127).

13. "Using Elk Hills and Alaskan Northern Slope Oil to Supply the Strategic Petroleum Reserve" (Oct. 21, 1980, EMD-81-4).

14. "Status of Strategic Petroleum Reserve Activities--October 1980" (Nov. 3, 1980, EMD-81-24).

15. "Status of Strategic Petroleum Reserve Activities--December 1980" (Dec. 22, 1980, EMD-81-37).

16. "Status of Strategic Petroleum Reserve Activities--February 1981" (Feb. 24, 1981, EMD-81-49).

17. "Status of Strategic Petroleum Reserve Activities--April 1981" (May 4, 1981, EMD-81-25).

18. "Status of Strategic Petroleum Reserve Activities--June 1981" (June 19, 1981, EMD-81-107).

19. "Status of Strategic Petroleum Reserve Activities--July 1981" (July 20, 1981, EMD-81-118).

20. "Status of Strategic Petroleum Reserve Activities--August 1981" (Aug. 28, 1981, EMD-81-136).

21. "The United States Remains Unprepared for Oil Import Disruptions" (Sept. 29, 1981, EMD-81-117).

22. "Status of Strategic Petroleum Reserve Activities--September 1981" (Oct. 2, 1981, EMD-82-7).

TABLES ON FISCAL YEAR 1981 SPR OIL CONTRACTS, RECEIPTS, AND STORAGE CAPACITY

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Table 1

Contracts Awarded Under Competition

Exchange of Naval Petroleum Reserve Oil

	Date of award	Barrels to be exchanged	Daily fill rates	Type of oil (note a)	Total price paid (note b)	First proposed delivery date	Last proposed delivery date
First Solicitation:		(millions)			($/barrel)		
Atlantic Richfield Company	9-18-80	1.5	4,110	Sour	32.62	9-80	12-80
	9-18-80	2.1	5,890	Sweet	34.62 - 35.42		
	10-01-80	5.7	15,671	Sweet	34.62 - 36.42	9-80	12-80
Getty Oil Company	10-01-80	1.8	5,000	Sweet	36.78	1-81	10-81
Coastal States Trading Company	10-01-80	5.5	15,000	Sweet	37.19 - 38.40	10-80	3-81
Chevron Oil Company	10-01-80	7.3	20,000	Sweet	37.66	11-80	3-81
Subtotal		23.9	65,671				
Supplemental Solicitation:							
Chevron Oil Company	10-31-80	3.4	9,178	Sour	29.06	12-80	9-81
USA Petroleum Chemical Corp.	10-31-80	2.0	5,507	Sour	33.92	12-80	6-81
Derby and Co., Inc.	10-24-80	3.4	9,178	Sweet	37.37 - 38.12	11-80	3-81
Derby and Co., Inc. (note c)	10-31-80	4.0	10,831	Sweet	37.37 - 38.12	11-80	4-81
Subtotal		12.8	34,694				
Total		36.7	100,365				

a/Oil quality is measured, among other things, by sulfur content. Sour crude is defined by DOE as crude having between 0.5 percent and 1.99 percent sulfur. Sweet crude has less than 0.5 percent sulfur.

b/Total of NPR oil value and total premium paid.

c/This award represents additional oil to be exchanged by Derby and Co., Inc. However, it is considered part of DFSC's October 24, 1980, contract with the company.

Source: Defense Fuel Supply Center

Table 2

Contracts Awarded Under January 1981

Open Continuous Solicitation

Contract date	Supplier	Total barrels to be delivered (note a) (millions)	Annualized daily fill rate	Type of oil (note b)	Delivery dates First	Delivery dates Last
Fiscal year 1981 delivery:						
2/13/81	Amoco Oil Co.	.7	1,918	Sweet	5/81	5/81
2/13/81	Derby & Co., Inc.	7.6	20,822	Sweet	3/81	6/81
		8.2	22,466	Sour	4/81	6/81
2/20/81	British Petroleum Oil Development, LTD	5.2	14,247	Sweet	4/81	6/81
2/20/81	Motor Oil Hellas	.9	2,466	Sweet	3/81	3/81
3/06/81	Houston Oil and Refining, Inc.	3.4	9,315	Sweet	5/81	7/81
		1.5	4,110	Sour	6/81	6/81
3/06/81	Listo Energy, Inc.	.6	1,644	Sweet	4/81	5/81
		1.0	2,740	Sour	5/81	6/81
3/10/81	Coral Petroleum, Inc.	2.0	5,479	Sweet	4/81	5/81
3/13/81	Coastal States Trading, Inc.	.7	1,918	Sweet	7/81	8/81
		.6	1,644	Sour	3/81	4/81
3/31/81	Amerada Hess Corp.	2.0	5,479	Sweet	6/81	6/81
3/31/81	U.S. and S.A. Enterprises, Inc.	4.2	11,507	Sour	4/81	5/81
6/09/81	U.S. and S.A. Enterprises, Inc.	.8	2,192	Sweet	6/81	8/81
6/09/81	Exxon	3.0	8,219	Sour	7/81	7/81
6/09/81	Chevron	.7	1,918	Sour	7/81	8/81
6/09/81	Conoco	1.0	2,740	Sweet	8/81	8/81
6/26/81	Derby & Co., Inc.	.9	2,466	Sweet	7/81	7/81
		2.7	7,397	Sour	7/81	8/81
6/26/81	Houston Oil and Refining	1.0	2,740	Sour	7/81	8/81
6/26/81	U.S. and S.A. Enterprises, Inc.	1.0	2,740	Sour	7/81	8/81
6/26/81	Coastal Bermuda	1.0	2,740	Sour	7/81	7/81
6/26/81	Amoco Oil Co.	.8	2,192	Sour	7/81	7/81
6/26/81	Exxon International	.55	1,507	Sweet	7/81	7/81
6/26/81	Listo Energy	.55	1,507	Sweet	8/81	8/81
6/26/81	Texaco U.S.A.	.5	1,370	Sour	7/81	7/81
7/10/81	Mobil Oil Corp.	1.9	5,205	Sour	7/81	8/81
7/10/81	Exxon U.S.A.	1.5	4,110	Sour	7/81	8/81

7/10/81	Exxon International	1.0	2,740	Sweet	8/81	8/81
7/10/81	Texaco U.S.A.	.8	2,192	Sour	8/81	8/81
7/21/81	Texaco International	3.0	8,219	Sour	8/81	9/81
8/05/81	Exxon International	2.3	6,301	Sour	9/81	9/81
8/05/81	Derby & Co.. Inc.	.7	1,918	Sour	9/81	9/81
8/19/81	Exxon U.S.A.	1.0	2,740	Sour	9/81	9/81
8/19/81	Derby & Co., Inc.	.4	1,096	Sweet	9/81	9/81
		.5	1,370	Sour	9/81	9/81
8/19/81	Arco Petroleum Products	.4	1,096	Sour	9/81	9/81
8/19/81	Coastal States Trading, Inc.	.2	548	Sweet	8/81	8/81
	Subtotal	66.8	c/ 183,014			
Fiscal year 1982 delivery:						
9/01/81	Exxon International	6.0	16,438	Sour	10/81	10/81
9/01/81	Derby & Co., Inc.	1.6	4,384	Sour	10/81	10/81
		.4	1,096	Sweet	10/81	10/81
9/15/81	Derby & Co., Inc.	.9	2,466	Sour	10/81	10/81
		.1	274	Sour	10/81	10/81
9/29/81	Exxon International	3.3	9,041	Sour	10/81	10/81
10/13/81	Derby & Co., Inc.	.4	1,096	Sour	11/81	11/81
11/25/81	U.S. and S.A. Enterprises, Inc.	.6	1,644	Sour	12/81	1/81
11/25/81	Derby & Co., Inc.	1.1	3,014	Sweet	12/81	12/81
		.4	1,095	Sweet	12/81	12/81
		.5	1,370	Sour	12/81	1/82
	Subtotal	15.3	41,918			
	Total	82.1	224,932			

a/Rounded to the nearest hundred thousand for the basic contract awarded on the date indicated and subsequent modifications.

b/Sweet crude for the SPR is defined as having less than 0.5 percent sulfur content, sour crude is defined as having between 0.5 percent and 1.99 percent sulfur content.

c/This represents the total volume awarded under fiscal year 1981 contracts divided by 365 days. Because of rounding, the column adds to 183,018 barrels per day.

Source: Defense Fuel Supply Center

Table 3

Volume of SPR Oil Stored in Caverns and Other Facilities

GAO reporting period	Volume of oil at start of period	Deliveries	Volume of oil at end of period	Average receiving rate: For reporting period	Average receiving rate: Since 10/01/80
		(millions of barrels)		(barrels per day)	
10/01/80 to 9/30/81	92.8	a/ 106.5	199.3	291,781	291,781
10/1/81 to 12/01/81	199.3	b/ 23.5	222.8	379,987	304,450

a/DOE completed receiving the first shipment of oil resulting from the fiscal year 1981 competitive exchange on September 23, 1980.

a/Deliveries include 641,490 barrels of Elk Hills Naval Petroleum Reserve oil delivered to the SPR via pipeline by Pacific Refining Company.

b/Deliveries include 258,067 of Alaskan North Slope (ANS) oil delivered to the SPR by Chevron Oil Company as a result of an October 2, 1981, settlement with the Government. According to the settlement, Chevron will deliver about $33 million worth of ANS oil to the SPR. Based on an estimated price of about $33 per barrel, DOE expects to receive a total of about 1 million barrels of ANS oil under the settlement.

Source: Department of Energy

Table 4

Status of Phase I SPR Storage Capacity

As of December 1, 1981

SPR site	Capacity constructed (note a)	Capacity ready to use (note b)	Volume of oil in underground storage as of 12/1/81	DOE's estimated completion date for additional capacity	Brief description of work to be done
		(millions of barrels)			
Weeks Island, LA	75.0	75.0	52.0	Completed	None
Bayou Choctaw, LA	43.8	43.8	41.6	Completed	None
Sulphur Mines, LA	25.6	12.5	7.6	January 1982--13.1 million barrels	Cavern being tested for pressure losses. Potential pressure losses to be repaired and above-ground piping to be connected.
West Hackberry, LA	48.9	48.9	47.8	Completed	None
Bryan Mound, TX	64.5	64.5	64.4	Completed	None
Total	257.8	244.7	c/ 213.4		

a/DOE estimates of storage capacity based on November 3, 1981, sonar tests and calculations by Texas Brine Corporation.

b/Storage facilities certified ready to receive oil.

c/Additional 9.4 million barrels of oil is in pipelines, tanks, and Phase II storage caverns. This brings total oil in the SPR system to 222.8 million barrels. About 6.7 million of the 9.4 million barrels is designated for Phase II storage facilities.

Source: Department of Energy

DOE/EP-0045

Strategic Petroleum Reserve

Annual Report

February 16, 1982

U.S. Department of Energy
Assistant Secretary Environmental
Protection, Safety and Emergency Preparedness
Strategic Petroleum Reserve

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EXECUTIVE SUMMARY

During 1981, the significant events for the Strategic Petroleum Reserve (SPR) Program included record high oil acquisition and fill rates, execution of a long term commercial crude oil purchase contract with the Mexican state oil company, continued development of Phase II facilities, and commencement of Phase III design.

Record Oil Acquisition and Fill Rates

The Department of Energy (DOE) has aggressively pursued oil purchases for the SPR during 1981 in order to take advantage of the favorable international oil market. A total of 230.3 million barrels of crude oil was in storage at the end of 1981. This compares to 107.8 million barrels in underground storage at the end of 1980. The average daily fill rate during 1981 was 335.8 thousand barrels per day. As of December 31, 1981 the SPR had 32.1 million barrels of crude oil under contract for delivery in 1982. In addition, under the terms of a settlement of an overcharge allegation, Chevron USA will supply $34.5 million worth of oil for the Reserve without cost to the Government.

Crude Oil Contract With Mexico

A long-term commercial contract was signed on August 20, 1981 with Petroleos Mexicanos (PEMEX), Mexico's state-owned oil company for purchase of approximately 110 million barrels of crude oil through 1986. This contract is the largest SPR oil purchase to date and provides the SPR with a reliable, long term source of oil. The contract provided for the SPR to purchase 24 million barrels between September 1, 1981 and December 31, 1981. Thereafter PEMEX will supply crude oil to the SPR at the rate of 50,000 barrels a day through August 31, 1986. Initial purchases were made at Mexico's official selling prices; the contract calls for quarterly price renegotiation thereafter.

Development of Phase II Facilities and Commencement of Phase III Design

Phase II includes the expansion of the storage capacities at Bryan Mound, West Hackberry, and Bayou Choctaw sites by a total of 290 million barrels. Phase II surface facilities construction has been completed at West Hackberry and Bryan Mound. Cavern leaching commenced at West Hackberry in May 1981. Approximately 39.8 million barrels of gross cavern volume was created through leaching at these two sites in 1981. Surface facilities to increase the Bryan Mound leach rate from 680 thousand barrels per day (MBD) to 980 MBD were completed in December 1981. This will permit acceleration of Phase II storage capacity development and oil fill rates at Bryan Mound. The increased leach rate will provide approximately 50 million barrels of additional storage capacity by the end of 1985 over the projections in the FY 1982 budget. At Bayou Choctaw, Phase II drilling activities were completed and construction of surface facilities was initiated.

Phase III involves the further expansion of two existing sites, Bryan Mound and West Hackberry, and the development of a new site located at Big Hill, Texas. Phase III will increase the SPR capacity by 210 million barrels. The Phase III National Environmental Policy Act process was completed when a Record of Decision was approved in January 1982. Final design is underway for Bryan Mound and Big Hill.

I. INTRODUCTION AND PROGRAM BACKGROUND

This Strategic Petroleum Reserve (SPR) 1981 Annual Report is submitted to the President and to the Congress by the U.S. Department of Energy in accordance with Section 165 of the Energy Policy and Conservation Act of 1975, P.L. 94-163, enacted December 22, 1975.

This report discusses Reserve development activities during 1981 and satisfies the Energy Policy and Conservation Act requirement that the Annual Report include:

1. A detailed statement of the status of the Reserve;
2. A summary of the actions taken to develop and implement the SPR Plan;
3. An analysis of the impact and effectiveness of such actions on the vulnerability of the United States to interruption in supplies of petroleum products;
4. A summary of existing problems with respect to further implementation of the SPR Plan; and
5. Any recommendations for supplemental legislation deemed necessary or appropriate by the Secretary of Energy to implement the Reserve Program.

Supplemental legislation, if required, will be addressed in separate reports to the Congress. Proposals for future SPR activities will be covered in amendments to the SPR Plan, funding requests, and informational reports to the Congress.

Section I provides an introduction to the Annual Report and a program background. The SPR Plan and Amendments are described in Section II. Costs incurred are detailed in Section III, as is the current status of the SPR. The drawdown system and vulnerability impact are set forth in Section IV. The Appendix contains detailed information on the status of each SPR site.

Program Background

The SPR Program was created by the Energy Policy and Conservation Act (P.L. 94-163), approved on December 22, 1975. In the aftermath of the 1973-1974 Arab oil embargo, the Congress declared it to be United States policy that a Reserve of up to 1 billion barrels of petroleum products be established to reduce the impact of disruptions in petroleum supplies and to carry out the obligations of the United States under the International Energy Program.

II. SPR PLAN AND AMENDMENTS

The Energy Policy and Conservation Act required submission to the Congress of a Strategic Petroleum Reserve Plan to detail the proposals for designing, constructing, and filling the Reserve. The SPR Plan was submitted on February 16, 1977, and became effective on April 18, 1977. The Plan discussed the development and implementation of the SPR.

The planned schedule for filling the Reserve was accelerated by SPR Plan Amendment No. 1. This Amendment was submitted to the Congress on May 25, 1977, and became effective on June 20, 1977. The schedule was advanced by two years by establishing a goal of 500 million barrels to be in storage by December 22, 1980.

Amendment No. 2 to the SPR Plan authorized an increase in the SPR size from 500 million barrels to 1 billion barrels of stored oil. The Amendment was transmitted to the Congress on May 18, 1978, and became effective on June 13, 1978. The Amendment described the plans to store 750 million barrels of petroleum by the Department of Energy in underground storage facilities. Decisions were not made regarding the methods for developing the final 250 million barrels.

On October 31, 1979, the Department of Energy submitted to the Congress the Distribution Plan for the SPR (Amendment No. 3, Energy Action No. 5). In accordance with the provisions of the Energy Policy and Conservation Act, the Plan became effective on November 15, 1979. The Distribution Plan describes the drawdown and distribution of crude oil from the five SPR storage sites.

III. STATUS OF THE STRATEGIC PETROLEUM RESERVE

A. PROGRAM DEFINITION

The first 750 million barrels of the SPR is currently being developed in three phases. Phase I consists of the conversion of five sites with existing storage capacity of approximately 250 million barrels, one in Texas and four in Louisiana, plus a Department of Energy marine terminal facility at St. James, Louisiana. The Phase I sites are Bryan Mound in Texas, and Bayou Choctaw, West Hackberry, Sulphur Mines, and Weeks Island in Louisiana.

Phase II consists of 290 million barrels expansion of three Phase I sites. The Bryan Mound site is being expanded by 120 million barrels and the West Hackberry site is being expanded by 160 million barrels, both by solution mining (leaching) new caverns. A further 10 million barrels will be added to Phase II through acquisition of an additional existing storage cavern at Bayou Choctaw.

Phase III, consisting of 210 million barrels, will involve the further expansion of two existing sites and the development of a new site. Bryan Mound will be expanded by 40 million barrels and West Hackberry will be expanded by 30 million barrels. Also, a new 140-million-barrel site located at Big Hill, Texas will be developed.

B. ORGANIZATION

The Energy Policy and Conservation Act, which authorized the SPR Program, created the Strategic Petroleum Reserve Office. The law provides that the Secretary of Energy shall act through this Office in exercising authority over the establishment, management, and maintenance of the SPR. Under James B. Edwards, who was sworn in as Secretary of Energy on January 23, 1981, DOE was reorganized, and the SPR program was placed under the Assistant Secretary for Environmental Protection, Safety and Emergency Preparedness, William A. Vaughan (confirmed by the Senate on September 18, 1981). The Strategic Petroleum Reserve Office consists of the Program Office in Washington, D.C., and the Project Management Office located in New Orleans, Louisiana. The total authorized staffing level is 192 persons.

C. SITE DEVELOPMENT

The status of the three phases of SPR site development of the Gulf Coast crude oil storage is described in the following sections. The SPR site complexes have been grouped according to their proximity to associated major pipelines and marine terminal facilities. The location of current SPR site complexes and the Seaway, Texoma, and Capline pipelines and the interconnecting pipelines are shown in Figure 1.

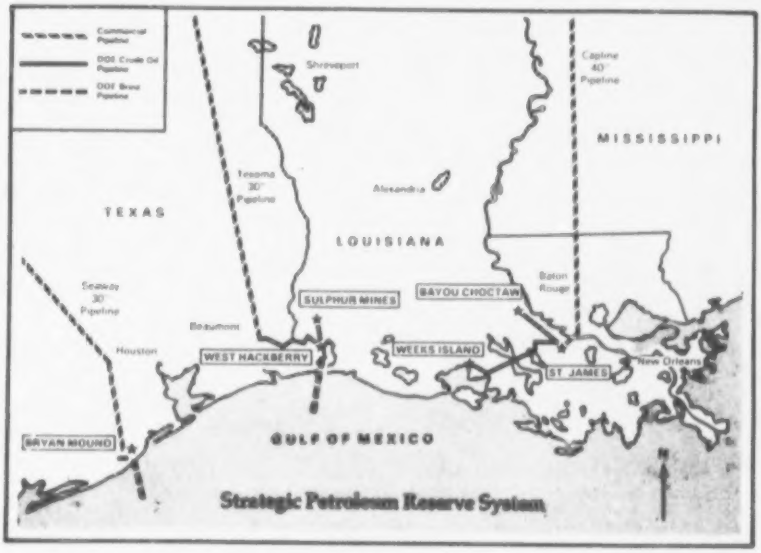
Commercial Pipeline
DOE Crude Oil Pipeline
DOE Brine Pipeline
Shreveport
Capline 40" Pipeline
MISSISSIPPI
Texoma 30" Pipeline
Alexandria
TEXAS
LOUISIANA
Seaway 30" Pipeline
Baton Rouge
SULPHUR MINES
BAYOU CHOCTAW
Beaumont
Houston
WEST HACKBERRY
WEEKS ISLAND
ST. JAMES
New Orleans
BRYAN MOUND
GULF OF MEXICO
N
Strategic Petroleum Reserve System

Figure 1. Location of Current SPR Site Complexes

1. Phase I and Phase II Status

Phase I development of five storage sites to achieve the capability to store 250 million barrels of oil was completed in 1980. During Phase II, three of these five sites, Bryan Mound, Texas, and West Hackberry and Bayou Choctaw, Louisiana, will be expanded. At West Hackberry and Bryan Mound, additional storage capacity will be achieved by constructing new leached caverns. At Bayou Choctaw, an existing cavern will be acquired to increase storage capacity. Phase I facilities are being supplemented and utilized to expand the existing sites under Phase II. As of December 31, 1981, approximately 230.3 million barrels of crude oil were stored in the SPR; 223.1 million barrels in Phase I facilities and 7.2 million barrels in Phase II facilities.

BRYAN MOUND - Brazoria County, Texas

Construction of Phase II surface facilities was completed in 1981. Leaching operations for Phase II cavern construction commenced in March 1980, and 35.5 million barrels of gross cavern volume had been created by December 31, 1981 (28.5 million barrels in 1981). In March 1981, steps were initiated to accelerate the leaching program at Bryan Mound and a modification of the brine disposal permit to increase the maximum disposal rate from 680 thousand barrels per day to 1.1 million barrels per day was submitted to the Environmental Protection Agency. The permit was issued in August 1981. It is planned to increase the average leaching rate to 980 thousand barrels per day which will provide an additional 50 million barrels of storage capacity by the end of 1985 over projections in the FY 1982 budget. Construction of surface facilities required to increase the leaching rate was completed in December 1981.

WEST HACKBERRY - Cameron Parish, Louisiana.

The bulk of Phase II construction and well drilling at West Hackberry was accomplished during 1980 and completed in 1981. Cavern leaching commenced in May 1981 within the planned 60-day start-up period. Approximately 11.3 million barrels of gross cavern volume had been created by December 31, 1981.

BAYOU CHOCTAW - Iberville Parish, Louisiana.

Phase II at Bayou Choctaw consists of the leaching of a new cavern (No. 102), which will be exchanged with Allied Chemical Corporation for its existing Cavern No. 17, which will be used by the SPR. The Phase II well drilling was completed and construction initiated in 1981. Cavern No. 102 leaching will begin in 1982.

SULPHUR MINES - Calcasieu Parish, Louisiana.

Phase I construction was completed in 1980. Start-up and oil fill were initiated in 1981. No expansion of Sulphur Mines beyond Phase I is planned.

WEEKS ISLAND - Iberia Parish, Louisiana.

Completion of Phase I construction and start-up of the Weeks Island facility was accomplished in 1980. Oil fill at this site began in 1980 and continued through 1981. No expansion of Weeks Island beyond Phase I is planned.

ST. JAMES TERMINAL - St. James Parish, Louisiana.

Completion of construction and facility start-up were accomplished in 1980. During 1981, the St. James Terminal was connected to the neighboring LOCAP Terminal to increase system fill and drawdown flexibility. This connection provides the capability to supply SPR oil to the Capline pipeline or receive oil through the Louisiana Offshore Oil Port. The St. James Terminal was utilized to offload tankers and deliver oil to Bayou Choctaw and Weeks Island during 1981.

2. Phase III Program Plan

Phase III involves the further expansion of two existing sites, Bryan Mound and West Hackberry, and the development of one new 140-million-barrel site at Big Hill, Jefferson County, Texas. The National Environmental Policy Act procedure for Phase III implementation was completed in January 1982.

Phase III detailed design work for Bryan Mound was accomplished in 1981. An Architect-Engineer contract for detailed design of the Big Hill site was awarded in September 1981. Completion of Phase III will bring the total SPR storage capacity to 750 million barrels. A summary of SPR crude oil capacities and inventories, by phase, is shown in Table 1.

Table 1. SPR Crude Oil Capacities and Inventory

	Planned Storage Capacity (million bbls)	Crude Oil Inventory (million barrels) 1981 Cumulative Total Sour	Sweet	Total
Phase I	250	129.4	93.7	223.1
Phase II	290	7.2	0	7.2
Phase III	210	0	0	0
Total	750	136.6	93.7	230.3

At Bryan Mound and West Hackberry, Phase III will consist of new leached caverns which will be connected to the existing site facilities for fill and drawdown. There will be no increase in the drawdown rates at these sites due to addition of Phase III capacity.

The Big Hill site, as currently planned, will include fourteen new leached caverns and the necessary surface facilities. Leaching water will be obtained from the Intracoastal Waterway, and brine will be discharged into the Gulf of Mexico. Fill and drawdown would be accomplished via a new 27-mile pipeline to the Sun Terminal, Nederland, Texas. The design drawdown rate will be 935 thousand barrels per day.

D. PROGRAM AND PROJECT MANAGEMENT

The Strategic Petroleum Reserve is managed through an overall system of cost, schedule, and technical performance controls. These three main variables are factored into management control systems and standards throughout the various levels of the SPR organization. The Program Office provides planning guidance to the Project

Management Office to complete and operate SPR facilities within approved program goals. The Project Management Office is responsible for detailed project level performance definition and implementation.

During FY 1981, the SPR has implemented the DOE Cost Schedule Control Systems Criteria and the Uniform Contractor Reporting System on all major contracts. These systems have significantly improved contractor reporting and information systems permitting better contract management and evaluation of contract performance.

During FY 1981, SPR procurements totaled $646 million. The SPR Project Management Office (PMO) made awards of $213 million, exceeding its contracting goals as established by the Department of Energy for Small and Disadvantaged Businesses. The SPR PMO and its prime contractors awarded over $34 million to Disadvantaged Businesses and $74 million dollars was awarded to Small Businesses, 137 percent of the goal.

Services continued to be provided in FY 1981 under existing contracts by: Parsons-Gilbane for construction management; Dravo Utility Constructors, Inc. for operations and maintenance; Jacobs/D'Appolonia Engineers for design engineering of modifications and upgrades to existing sites; The Aerospace Corporation for systems engineering and integration; Sandia National Laboratories for geotechnical engineering; McNeese State University and Texas A&M Research Institute for monitoring of brine disposal into the Gulf of Mexico from the West Hackberry and Bryan Mound sites, respectively; OAO Corporation, a minority (Section 8(a)) firm, for management and technical support services; Williams, Fenix & Scisson for drilling management; Spectra Research Systems, Inc. for safety and risk analysis, and Thacker Construction Company, a minority (Section 8(a)) firm, for construction services in support of modifications and upgrades of existing SPR sites.

Major new contracts included Walk, Haydel and Associates, Inc., for design engineering services for the Big Hill, Texas site, and Jacobs/D'Appolonia for design engineering services for modifications and upgrades of existing sites and Phase III expansion of Bryan Mound and West Hackberry, and to OAO Corporation for continuation of management and technical support services.

On December 30, 1981, a contract was awarded to Petroleum Operations and Support Services, Inc., a subsidiary of Kaneb Services, Inc., for continuation of operations and maintenance of SPR facilities. The contract term is for three years beginning in January 1982 plus two one-year options.

Options to extend periods of performance for contracts were exercised with: Seaway Terminalling Company for marine terminalling for fill at Bryan Mound, Reguard Securities, a minority (Section 8(a)) firm, for New Orleans security protection services; The Aerospace Corporation for systems engineering and integration; Spectra Research Systems, Inc., a small business, for safety and risk analysis; and McNeese State University and Texas A&M Research Institute for monitoring of brine disposal into the Gulf of Mexico from the West Hackberry and Bryan Mound sites, respectively.

Construction procurement activity was completed on Phase I and Phase II at Bryan Mound and is nearing completion on Phase II at West Hackberry. Numerous subcontracts were awarded by Parsons-Gilbane to complete Phase II construction at West Hackberry.

During 1981 a solicitation was issued and proposals were evaluated for security services for SPR sites. In November 1981, Wells Fargo Guard Services, Inc., a security services contractor, was selected for negotiation and a contract awarded in January 1982.

Major emphasis was placed upon improvement of the Department of Energy real property management systems during FY 1981. Particular emphasis has been placed on the property responsibilities of a new operations and maintenance contractor, which should lead to marked improvement of the Department of Energy/SPR property management system.

E. BUDGET AND COST

1. Appropriations

Almost $12.2 billion has been appropriated for the SPR through FY 1982, including entitlements receipts for FY 1981 under the authority of the Energy Security Act. Distribution of appropriated funds among activities is shown in Table 2.

2. Budget Actions During 1981

President Reagan's FY 1982 budget of March 1981 proposed budget authority of $3,883,408,000 for the Strategic Petroleum Reserve, consisting of $9,000,000 for Planning, $3,684,000,000 for Petroleum Acquisition and Transportation, $178,496,000 for Storage Facilities Development and Operations, and $11,912,000 for Program Direction. Subsequently, on September 30, 1981, the President amended this request, reducing it by $466 million as part of an overall 12 percent reduction in Federal civilian spending.

In May 1981, a reprogramming of $18,000,000 from Petroleum Acquisition and Transportation funding to Storage Facilities Development and Operations/Phase I for the Bryan Mound condemnation settlement was completed.

In June 1981, the Congress appropriated $1,305,000,000 as a supplemental for FY 1981 for the purchase of oil. These funds were appropriated to offset the entitlements receipts lost when oil was decontrolled in January 1981. Additionally, $507,000 was appropriated for FY 1981 pay cost increases.

In August 1981, the Omnibus Budget Reconciliation Act of 1981 was enacted. This Act authorizes appropriation of up to $3,900,000,000 for FY 1982 for an off-budget oil account which is referred to as the "SPR Petroleum Account," the expenditures of which will not be included in Federal budget totals.

In September 1981, the reprogramming of $7,334,070 from Petroleum Acquisition and Transportation funding to Storage Facilities Development and Operations/Phase I for the West Hackberry condemnation settlement was completed.

In December 1981, the Congressional action on the SPR FY 1982 appropriations was completed. Consistent with other Federal programs in the Interior and Related Agencies appropriations bill, the SPR on-budget activities were reduced four percent. The Oil Acquisition and Transportation activity was funded at the FY 1982 level originally proposed by the President.

Table 2. SPR Appropriations
(In Thousands of Dollars)

Fiscal Year	Petroleum Acquisition and Transportation	Storage Facilities Development and Operations	Planning	Program[1] Direction	Total
1976	...	300,000	12,000	1,975	313,975
1977	440,000	...	4,000	3,826	447,826
1978	2,703,469	463,933	7,915	6,789	3,182,106
1979	2,885,670	103,290	12,200	5,911	3,007,071
Reprogramming During 1979	-529,214	+529,214			...
Reprogramming During 1980					
# 1	-20,391		+12,000	+8,391	...
# 2	-1,881			+1,881	...
Transfer in FY 1980[2]				190	190
FY 1980 Rescission	-2,000,000				-2,000,000
FY 1981 Appropriations	2,662,948[3]	108,165[4]	8,000	11,391	2,790,507
FY 1982 Appropriations	3,684,000[5]	171,356	8,640	11,436	3,875,432
Total Appropriations	9,824,601	1,675,961	64,755	51,788	11,617,105
Entitlements (FY 1981)[6]	542,146				542,146
Total Including Entitlements	10,366,747				12,159,251

[1] Excludes funds appropriated to other DOE accounts but used to finance aspects of SPR Program Direction.

[2] Represents funds transferred to the Strategic Petroleum Reserve in FY 1980 to accompany a transfer of five positions.

[3] Includes supplemental appropriations of $1,305,000,000.

[4] Includes $25,334,000 reprogrammed from Petroleum Acquisition for land condemnation awards —$18,000,000 for Bryan Mound and $7,334,070 for West Hackberry.

[5] Pursuant to the Omnibus Budget Reconciliation Act of 1981, Petroleum Acquisition and Transportation funding was placed off-budget in FY 1982.

[6] Represents entitlements funding made available and obligated in FY 1981.

F. REAL ESTATE, ENVIRONMENTAL COMPLIANCE, AND PERMITS

1. Real Estate

The U.S. Army Corps of Engineers is the Department of Energy's agent for real estate acquisition for the SPR under an existing Memorandum of Understanding. Negotiations were completed with the State of Louisiana and eminent domain proceedings commenced to acquire the last fee simple (full ownership) interest in land for the West Hackberry, Louisiana (Phase I) site. Specific major acquisition actions consisted of: a Federal court award of $22.5 million as compensation for 499.47 acres of fee land, less sulfur interest, comprising the Bryan Mound facility; $17.5 million negotiated stipulated settlement for 290.30 acres of fee land, which is a portion of West Hackberry facility (Phase I); and a tentative agreement reached with Allied Chemical Corporation for acquiring 2.99 acres of surface fee area and 6.89 acres of subsurface area, including Cavern 17 on the Bayou Choctaw salt dome, through revestment of a similar quantity of land area and Cavern 102 currently being developed by the SPR. Work continued on settling court actions, finalizing purchase transactions and obtaining final opinions of title for the remaining Phase I and Phase II real estate interests. Letters of Consent were issued to several firms to cross Government-owned easement areas.

2. Environmental Compliance

The environmental compliance process for implementation of Phase III, pursuant to the National Environmental Policy Act (NEPA), was completed in January 1982 with the issuance of a Record of Decision. The Final Supplemental Environmental Impact Statement for SPR Phase III Development (DOE/EIS-0075) was published in October. The Supplement assessed site specific environmental implications of increasing the Reserve by 210 million barrels to a total of 750 million barrels of crude oil storage.

3. Permits (Brine Line)

Major accomplishments in 1981 include actions related to Environmental Protection Agency (EPA) National Pollutant Discharge Elimination System (NPDES) permits. In April 1981, EPA granted authorization to discharge brine from the West Hackberry site into the Gulf of Mexico, under conditions of the permit issued in August 1980. The brine discharge monitoring plan, also a condition of that permit, received the EPA Regional Administrator's approval in January and was implemented at the initiation of brine discharge in May 1981.

Environmental monitoring at the site continued throughout the year. Although it is too early to conclusively assess the environmental impacts of brine discharge at West Hackberry, no acute impacts have been detected. It is evident, however, that the diffuser system works as designed; the discharged brine is effectively diluted and dispersed. This has been amply demonstrated at Bryan Mound in 70 feet of water and at West Hackberry in 30 feet of water.

The NPDES permit modification to increase the daily maximum brine discharge at Bryan Mound to 1.1 million barrels per day was issued in August 1981. Also in August, the scope of the monitoring plan at Bryan Mound was reduced, based on the report of the findings of the first year's environmental monitoring at Bryan Mound. The impacts of brine discharge into the Gulf of Mexico at Bryan Mound were less than predicted; no acute effects were noted.

G. CRUDE OIL LOGISTICS, DISTRIBUTION, AND INVENTORY

1. Oil Acquisition Contracts

During 1981 the SPR crude oil procurement agent, the Defense Fuel Supply Center, awarded contracts under an open continuous solicitation which provided for delivery of 88,069,000 barrels to SPR storage sites. This solicitation, issued January 30, 1981, provided for receipt of offers and subsequent awards on a biweekly basis. By this means, the SPR was able to take advantage of the favorable spot market conditions which prevailed during 1981. This crude oil acquisition approach will be continued in 1982 dependent on market conditions and SPR acquisition requirements.

In addition to the contracts awarded under the open continuous solicitation, on December 10, 1981, the Defense Fuel Supply Center awarded a term contract for 2.1 million barrels of sour crude to be delivered during the period April through October 1982. This award resulted from a solicitation for the term purchase of up to 36.5 million barrels of sour crude for delivery during 1982.

On August 26, 1981, the SPR entered into a commercial contract with Petroleos Mexicanos (PEMEX), Mexico's state-owned oil company, which provided for delivery of 24 million barrels of sour crude oil between September 1, 1981, and December 31, 1981, and delivery of 50 thousand barrels per day of crude oil from January 1, 1982, through August 31, 1986, for a total of approximately 110 million barrels.

As part of a Consent Order in settlement of overcharge allegations between Standard Oil Company of California and the Department of Energy, effective October 2, 1981, Chevron agreed to deliver to the SPR a quantity of Alaskan North Slope crude oil with a delivered value of approximately $34.5 million. The amount to be delivered under this Consent Order is 1,029,000 barrels, of which 772,000 barrels were received in calendar year 1981. The balance was delivered in January 1982.

As a result of a Naval Petroleum Reserves (NPR) contract settlement with the Pacific Refining Company, a 1980 direct purchaser of NPR crude oil, the SPR acquired 67,000 barrels of crude oil from the NPR (Elk Hills). The crude oil was transported by commercial pipeline to the SPR via the Sunoco terminal at Nederland, Texas.

In November 1981, a decision was made by the Assistant Secretary, Environmental Protection, Safety and Emergency Preparedness, that the SPR will purchase any excess production from NPR No. 1 (Elk Hills) which can be direct shipped to the SPR through commercial pipelines prior to April 5, 1982 when the production is committed to the Department of Defense. The exact quantities purchased will depend upon available pipeline capacity.

Table 3 provides a summary of oil acquisition in 1981 and the status of deliveries thereunder as of December 31, 1981.

Table 3. Oil Acquisition Summary for 1981
(As of December 31, 1981)

Source	Quantity (1000 bbl)	1981 Deliveries to SPR (1000 bbl)	Balance to be Delivered (1000 bbl)
Open Continuous Solicitation	88,069	81,087	7,423
Term Contract	2,140	--	2,140
PEMEX	109,200	20,013	89,187
Chevron Consent Order	1,029	772	257
NPR/Pacific Refining Co.	67	21	46
Total	**200,505**	**101,893**	**99,053**

Table 4. Crude Oil Received Through 1981

Source Country or State	Net Contract Quantity (million barrels)	Percent of Total (%)
North Sea (U.K.)	57.3	24.9
Mexico	57.1	24.8
Alaska	28.1	12.2
Libya	23.8	10.3
Iran	18.2	7.9
Saudi Arabia	15.5	6.7
Nigeria	8.2	3.6
Dubai	4.9	2.1
Ecuador	4.2	1.8
Egypt	2.5	1.1
Algeria	2.4	1.0
Gabon	2.4	1.1
Texas	1.9	0.8
Norway	1.9	0.8
Venezuela	0.9	0.4
Cameroon	0.6	0.3
Other Domestic	0.4	0.2
Totals	230.3	100.0

During 1981, 122.5 million barrels of crude oil were added to the Reserve. In addition to the deliveries shown in Table 3, 20.7 million barrels of crude oil were delivered under the 1980 Naval Petroleum Reserves Crude Oil Exchange Contracts which terminated October 31, 1981. Table 4 shows the crude oil received since inception of the program by state or country of origin. Of the total oil in storage, 59 percent is high sulfur (sour) and 41 percent is low sulfur (sweet). Table 5 provides SPR crude oil specifications.

2. Crude Oil Capacity and Inventory

At the end of 1981, the SPR had 257.2 million barrels of storage capacity available for fill with 230.3 million barrels of crude oil in storage or under SPR control. As of that time an additional 32.1 million barrels of crude oil are under contract for delivery during 1982. Table 6 provides statistics on the SPR crude oil inventory as of December 31, 1981. Crude oil inventories at the end of 1980 are also provided.

The net Federal cost of 230.3 million barrels of crude oil now in storage, including transportation charges, is approximately $26.85 per barrel.

Table 5. Current SPR Crude Oil Specifications

	SPR Type						
Characteristic	I	II	III	IV	V	VI	Appropriate ASTM Test Method
API Gravity (°API)	30 Min.	40-45	30-36	34-40	36-41	26 Min.	D 1298
Total Sulfur (Wt. %), Max.	1.99	0.25	0.50	0.25	0.50	1.25	D 129, D 1552, or D 2622
Pour Point (°F), Max.	50	50	50	50	50	50	D 97
Salt Content (Lbs./1,000 Bbls.), Max.	50	50	50	50	50	50	D 3230
Viscosity (SUS @ 60°F), Max.	150	150	150	150	150	200	D 445 & D 2161
Reid Vapor Pressure (Psia @ 100°F), Max.	11	11	11	11	11	11	D 323
Total Acid Number (mg KOH/g), Max.	0.40	0.40	0.40	0.40	0.40	0.40	D 664
Water and Sediment (Vol. %), Max.	1.0	1.0	1.0	1.0	1.0	1.0	D 96, or D 95 & D 473
Yields (Vol. %)							D 2892 and/or D 1160
Naphtha (>375°F)	24-30	35-42	21-29	29-36	30-38	15-20	
Distillate (375-620°F)	17-31	21-35	23-37	31-45	19-33	24-27	
Gas Oil (620-1050°F)	26-38	20-34	28-42	20-34	23-37	38-42	
Residuum (<1050°F)	10-19	4-9	7-14	0-5	7-14	15-20	

Table 6. SPR Crude Oil Inventory (December 31, 1981)

		Crude Oil Inventory (Million bbl's) 1981 Cumulative Total			
Storage Site	Location	Sour*	Sweet**	Total	End of Year 1980
Bryan Mound	Brazoria County, TX	7.2	64.4	71.6	38.4
West Hackberry	Cameron Parish, LA	35.0	12.8	47.8	38.0
Bayou Choctaw	Iberville Parish, LA	25.9	16.2	42.1	25.2
Weeks Island	Iberia Parish, LA	57.6	0	57.6	4.3
Sulphur Mines	Calcasieu Parish, LA	9.1	0	9.1	0
Subtotal		134.8	93.4	228.2	105.9
Tanks and Pipelines		1.8	.3	2.1	1.9
Total		136.6	93.7	230.3	107.8

* High Sulphur Content
** Low Sulphur Content

IV. DRAWDOWN SYSTEM AND VULNERABILITY IMPACT

A. DRAWDOWN CAPABILITY

The current maximum total system drawdown rate capability is 1.7 million barrels per day. For each SPR storage site, the applicable distribution facilities (i.e., terminal and pipeline complex) and maximum sustainable drawdown rates are shown in Table 7.

Table 7. SPR Drawdown System (1981)

Site	Distribution System Pipeline	 Tanker Terminal	Drawdown Rate (thousand bbl/d)
Bryan Mound	Seaway	Seaway	387
West Hackberry	Texoma	Sunoco	402
Sulphur Mines	Texoma	Sunoco	100
Bayou Choctaw	Capline	DOE/St. James	240
Weeks Island	Capline	DOE/St. James	590
Total			1,719

Tie-ins are in place to accommodate drawdown through the commercial facilities. In addition, detailed plans and procedures have been developed for moving crude oil out of storage into the commercial distribution system.

Upon completion of fill of Phase II facilities, the SPR will have the capability to sustain a drawdown of up to 3.5 million barrels per day as indicated in Table 8.

Although the facilities to draw down up to 3.5 million barrels per day of oil are in place, Phase II rates cannot initially be sustained because they are limited by the fill levels of the individual storage caverns. As the Phase II expansion and construction of additional storage caverns at Bryan Mound and West Hackberry progress between 1982 and 1986, the sustained drawdown rate that can be achieved will increase from 1.7 to 3.5 million barrels per day.

Table 8. SPR Drawdown Upon Completion of Phase II (1986)

Site	Drawdown Rate (thousand bbl/d)
Bryan Mound	1,054
West Hackberry	1,402
Bayou Choctaw	480
Weeks Island	590
Sulphur Mines	*
Total	3,526

*Combined drawdown rate of West Hackberry and Sulphur Mines is 1.4 million bbl/d.

B. VULNERABILITY IMPACT

During 1981, the SPR has significantly increased its capability to provide an effective response to a petroleum supply disruption. Since the end of calendar year 1980, the SPR oil inventory has been increased from 107.8 million barrels to 230.3 million barrels. This inventory is equivalent to about 12 percent of total U.S. net imports (crude oil and petroleum products) during 1981 or about 43 days of total U.S. net imports. The current maximum initial SPR drawdown capability of 1.7 million barrels per day is equivalent to 32 percent of the average daily U.S. net petroleum imports during 1981 (excluding imports for the SPR).

APPENDIX - SPR SITE STATUS

A. Bayou Choctaw
B. Weeks Island
C. Bryan Mound
D. Sulphur Mines
E. West Hackberry
F. St. James Terminal

INTRODUCTION

The storage sites described in this Appendix are located on the Gulf Coast where they are accessible to major interstate crude oil distribution pipelines and port facilities. These locations will allow rapid withdrawal (drawdown) of the Reserve should supplies to the United States be interrupted for any reason, and will expedite its entrance into the normal crude oil distribution system of the country.

Most crude oil transported to the United States enters through the Gulf of Mexico, supplying local refineries, or is transported to inland refineries via pipelines. A significant portion of the imported crude oil is transferred inland through three major pipelines: the Seaway and Texoma pipelines to Cushing, Oklahoma, and the Capline pipeline to Patoka, Illinois. Additional smaller pipelines further distribute oil from the major pipelines throughout the Midwest. The Gulf Coast is a desirable location for storage because the Department of Energy can take advantage of existing commercial crude oil pipeline distribution systems as well as ocean transportation during a drawdown of the Reserve.

Each of the site complexes currently being developed for the SPR will be connected to one of the three major pipelines and tanker docks. The SPR site complexes have been grouped according to their associated major pipelines and marine terminal facilities.

A. BAYOU CHOCTAW

1. PHASE I

Location

Iberville Parish, Louisiana (12 miles southwest of Baton Rouge, Louisiana).

Acquisition

Acquired 355.95 acres fee simple by condemnation April 1977, from numerous private owners. Allied Chemical Corporation was the previous operator.

Environmental/Permits

Environmental Impact Statement published December 1976, supplement published May 1977.

Four major Federal and State permits related to pipeline, well pad, storage, and storm water runoff acquired in 1978.

Site Description

43.8-million-barrel storage facility consisting of four existing caverns.

Oil, brine, raw water piping distribution system connecting caverns with central piping and 18 pumps totaling over 20,000 horsepower.

Twelve brine disposal wells 2.5 miles offsite; pipeline for supplying brine to Allied Chemical Corporation.

100,000-barrel brine pit, control center, buildings, roads, well pads, and dikes.

Water intake structure in Cavern Lake on site.

System Parameters

Oil fill via 36-inch-diameter, 39-mile pipeline to St. James Terminal.

Design pumping rate - 240,000 bbl/d.

Sustained system rate - 110,000 bbl/d (brine disposal-constrained).

Raw water design pumping rate - 480,000 bbl/d.

Brine disposal - 110,000 bbl/d projected disposal rate.

Drawdown

Drawdown via 36-inch-diameter, 39-mile pipeline to St. James Terminal and to Capline pipeline.

240,000 bbl/d design capability.

2. PHASE II

Action has been initiated to acquire existing Cavern No. 17 for SPR crude oil storage which will provide an additional 10 million barrels of storage volume in Phase II. In conjunction with that acquisition, a new cavern, 102, is being developed to approximately 5-million-barrel capacity. Upon completion, an exchange will be negotiated with Allied Chemical Corporation for Cavern 17 to enhance site integrity.

3. MAJOR ACCOMPLISHMENTS

Completed construction of pad and drilled well for Cavern No. 102, Phase II.

Completed installation of permanent power.

Completed construction of security operations center.

B. WEEKS ISLAND

Location

Iberia Parish, Louisiana (95 miles southwest of New Orleans).

Acquisition

Acquired 382.92 acres fee simple subsurface and 6.63 acres fee simple surface by condemnation September 1977, from Morton Salt Company.

Environmental/Permits

Environmental Impact Statement published January 1977; supplement published August 1977.

Major Federal permit related to oil pipeline to St. James Terminal acquired in 1978. Three major Federal and State permits related to oil storage, air emissions and storm water, and treated sewage effluent discharge acquired in 1979.

Site Description

Conventional salt mine containing two levels of rooms and pillars to be dedicated to sour crude oil.

Oil piping distribution system consists of 11 (10 operational and 1 reserve) submersible electric pumps in the mine to boost crude to the surface and twin main-line pumps (plus one reserve) to push crude to St. James Terminal during drawdown. Pumps total 17,000 horsepower.

500,000-gallon firewater tank and pumps.

Mine inert gas and vapor recovery systems.

System Parameters

Oil fill via 36-inch-diameter, 69-mile pipeline from St. James Terminal.

Design pumping rate - 480,000 bbl/d.

Sustained system rate - 350,000 bbl/d.

Drawdown

Drawdown via 36-inch-diameter, 69-mile pipeline to St. James Terminal and to Capline pipeline.

590,000 bbl/d design capability.

Major Accomplishments

Injected 53.3 million barrels of sour crude during 1981.

Demonstrated capability to receive oil at design rate of 480,000 bbl/d on a sustained basis.

Demonstrated capability of submersible pumps to withdraw at design rate - 590,000 bbl/d.

C. BRYAN MOUND

1. PHASE I

Location

Brazoria County, Texas (3 miles southwest of Freeport, Texas).

Acquisition

Acquired 499.47 acres fee simple by condemnation April 1977, from Freeport Mineral Company and other owners. Dow Chemical Company was the previous operator.

Environmental/Permits

Environmental Impact Statement published January 1977; supplement published December 1977.

Five major Federal and State permits related to pipelines, water intake, and storage acquired in 1977 and 1978.

Site Description

64.5 million barrel storage facility consisting of four existing caverns.

Oil, brine, and raw water piping distribution system connecting caverns with central plant, water intake structure and disposal wells, consists of over 25,000 feet of piping and 17 pumps totaling over 21,000 horsepower.

Four 200,000-barrel oil storage tanks.

Six deep-injection brine disposal wells 2 miles off-site.

15,000 and 100,000-barrel brine pits, oil-brine separator, maintenance and control center buildings, roads, well pads, and dikes.

Water intake structure on the Brazos River, connected by a 36-inch-diameter pipeline.

System Parameters

Fill via 30-inch-diameter, 3.6-mile pipeline to Seaway Docks.

Design oil injection rate - 240,000 bbl/d.

Sustained system rate - 180,000 bbl/d.

Brine disposal 980,000 bbl/d with Gulf of Mexico brine disposal line (Phase II capability now available).

Drawdown

Drawdown via 30-inch-diameter pipelines, 3.6 miles to Seaway docks and 4.6 miles to Seaway pipeline.

387,000 bbl/d capability - demonstrated September 1979.

2. PHASE II

Location

On existing site.

Acquisition

Property acquired in Phase I.

Environmental/Permits

Seaway Environmental Impact Statement published June 1978.

Two major Federal permits related to brine disposal pipeline issued in 1978.

Site Description

120 million barrels of new leached storage capacity consisting of 12 caverns.

36-inch-diameter, 14.6-mile brine disposal pipeline (13 miles offshore) to Gulf of Mexico.

Oil, brine, and raw water piping distribution system connecting with central plant, water intake, and brine pipeline; additional pumps for leaching and brine disposal. Consists of over 76,000 feet of piping and 16 pumps totaling approximately 17,000 horsepower.

6 caverns with 3 wells each and 6 caverns with 2 wells each to approximate depth of 4,500 feet.

System Parameters

Fill via 30-inch-diameter, 3.6-mile pipeline to Seaway docks.

Projected sustained rate of fill 180,000 bbl/d.

Raw water design pumping rate - 1,548,000 bbl/d.

Brine disposal - 980,000 bbl/d average projected disposal rate (permit limitation 1,100,000 bbl/d).

Drawdown

Drawdown via 30-inch-diameter pipelines; 3.6 miles to Seaway docks and 4.6 miles to Seaway pipeline.

Design capability - 1,054,000 bbl/d.

3. MAJOR ACCOMPLISHMENTS

Construction completed to increase leach rate and expand brine disposal to 980,000 bbl/day.

Completed fill of Phase I caverns September 1981.

Commenced injection of sour crude into Phase II caverns.

Continued leaching of Phase II caverns.

D. SULPHUR MINES

Location

Calcasieu Parish, Louisiana (2 miles west of Sulphur, Louisiana, and 20 miles north of West Hackberry salt dome).

Acquisition

Acquired 109.63 acres fee simple and 64.52 acres conditional fee by condemnation in February 1979, from Allied Chemical Corporation.

Environmental/Permits

Environmental Impact Statement published March 1978.

Three major Federal and State permits for pipeline construction, oil storage, and air emission acquired in 1978. Environmental Protection Agency discharge permits for storm water and sewage acquired in 1980.

Site Description

25.6 million barrel storage facility consisting of three existing caverns.

Oil, brine, raw water piping distribution system connecting caverns with central plant, water intake structure, and brine disposal wells. Consists of over 77,000 feet of piping and 18 pumps totaling over 8,000 horsepower.

Four deep-injection brine disposal wells.

Two 100,000-barrel brine ponds, control center buildings, roads, well pads, and dikes.

Water intake structure 1.5 miles offsite on Houston Canal (Sabine River Diversion Canal No. 5) connected to facility by a combination of 16- and 12-inch pipeline.

System Parameters

Oil fill via 16-inch-diameter, 17-mile spur pipeline connecting to existing West Hackberry-Nederland pipeline at Intracoastal Waterway.

Design pumping rate - 100,000 bbl/d.

Sustained system rate - 80,000 bbl/d (brine disposal-constrained).

Brine disposal - 80,000 bbl/d projected sustained rate.

Drawdown

Drawdown via 16-inch-diameter spur pipeline to Intracoastal Waterway, then through 42-inch-diameter West Hackberry line, 34.4 miles to Sunoco Terminal in Nederland, Texas.

Design capability - 100,000 bbl/d.

Major Accomplishments

Conducted start-up operations and initiated fill.

Completed construction of Security Operations Center.

E. WEST HACKBERRY

1. PHASE I

Location

Cameron Parish, Louisiana (12 miles southwest of Lake Charles, Louisiana).

Acquisition

Acquired 405.36 acres fee simple by condemnation in April 1977, from numerous landowners including the Lowery, Ellender, and Hamilton families. Olin Corporation was the previous site operator.

Environmental/Permits

Environmental Impact Statement published January 1977; supplement published April 1977.

Six major Federal and State permits related to pipelines, drilling pads, water intake, and storage acquired in 1977 and 1978.

Site Description

48.9-million-barrel storage facility consisting of five existing caverns.

Oil, brine, raw water piping distribution system connecting caverns with center plant, water intake structure, and disposal wells. Consists of over 60,000 feet of piping and 12 pumps totaling over 17,000 horsepower.

Ten deep-injection brine disposal wells 2 miles off-site.

175,000 barrel brine pit, oil-brine separator, control center and maintenance buildings, roads, well pads, and dikes.

Water intake structure on Intracoastal Waterway, 42-inch-diameter, 4.5-mile pipeline connecting to site.

System Parameters

Fill via 42-inch-diameter, 42-mile pipeline from Sunoco Terminal, Nederland, Texas.

Design oil injection rate - 225,000 bbl/d

Sustained system rate - 175,000 bbl/d (brine disposal-constrained).

Brine disposal - 1,088,000 bbl/d with Gulf of Mexico brine disposal line (Phase II capacity now available).

Drawdown

Drawdown via 42-inch-diameter, 42-mile pipeline to Sunoco Terminal, Nederland, Texas.

402,000 bbl/d capability - demonstrated September 1979.

2. PHASE II

Location

Adjacent to existing Phase I site.

Acquisition

Acquired 160.0 additional acres fee simple adjacent to Phase I property in two actions, July 1979 and March 1980. Total acreage through Phase II is 565.36 acres fee simple.

Environmental/Permits

Texoma Environmental Impact Statement published November 1978.

Two major Federal permits related to a brine pipeline acquired in 1980.

Site Description

160 million barrels of new leached storage capacity consisting of 16 caverns.

36-inch diameter, 27-mile brine disposal pipeline (9 miles offshore) to Gulf of Mexico.

20-mile, 69-kV power transmission line.

Oil, brine, raw water piping distribution system connecting caverns with central plant, water intake, and brine pipeline with additional pumps for leaching and brine disposal. Consists of over 100,000 feet of piping and 35 pumps totaling over 45,000 horsepower.

16 cavern wells to approximate depth of 4,500 feet each.

System Parameters

Fill via existing 42-inch-diameter, 42-mile pipeline from Sunoco Terminal.

Sustained system rate - 175,000 bbl/d.

Raw water design pumping rate -1,400,000 bbl/d.

Brine disposal - 1,088,000 bbl/d design disposal rate.

Drawdown

Drawdown via existing 42-inch-diameter, 42-mile pipeline to Sunoco Terminal, Nederland, Texas.

1,400,000 bbl/d drawdown capacity.

3. MAJOR ACCOMPLISHMENTS

Initiated Phase II leaching in May 1981.

Completed recertification of Cavern No. 6.

Completed fill of Phase I capacity.

Completed construction of Phase II surface facilities.

F. ST. JAMES TERMINAL

Location

St. James Parish, Louisiana (45 miles southeast of Baton Rouge, Louisiana, on the Mississippi River).

Acquisition

Acquired 104.76 acres fee simple for terminal by condemnation in May 1978.

Acquired 47.68 acres fee simple for docks by condemnation in July 1978.

Environmental/Permits

St. James' Environmental Impact Statement is a component of the Bayou Choctaw supplement, published May 1977, and the Weeks Island supplement, published August 1977.

Two major Federal and State permits related to dock construction acquired in 1978. Environmental Protection Agency discharge permit for storm water and sewage acquired in 1980.

Site Description

Terminal facilities include six storage tanks totaling 2 million barrels of capacity, tie-ins to Koch Oil Company Terminal, Bayou Choctaw, Weeks Island, and to LOCAP Capline pipeline and Capline terminal complex.

Oil distribution piping system connecting docks, tanks, and pump station. Consists of over 35,000 feet of piping and eight pumps totaling over 12,000 horsepower, metering systems, and maintenance and central buildings.

Two docks with one berth each, able to accommodate vessels of up to 123,000 long tons maximum loaded displacement. A 42-inch-diameter pipeline connects the docks with the storage tanks.

System Parameters

Tanker unloading - three marine unloading arms per dock with design capacity of 20,000 bbl/hr per arm.

Distribution from terminal:

To Bayou Choctaw: design pumping rate - 240,000 bbl/d;

To Weeks Island: design pumping rate - 400,000 bbl/d.

Terminal throughput:

Fill sustained system rate -350,000 bbl/d;

Drawdown rate - 830,000 bbl/d (combined rate of Bayou Choctaw and Weeks Island sites).

Drawdown

Crude oil from Bayou Choctaw and/or Weeks Island to be distributed across docks and to Capline.

Major Accomplishments

Installed mixers and stripping system in all six storage tanks.

Completed pipeline connection to LOCAP.

Demonstrated that system can receive 350,000 bbl/d on a sustained basis.

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CURRENT CONDITION OF THE STRATEGIC PETROLEUM RESERVE

THURSDAY, MARCH 25, 1982

U.S. Senate,
Subcommittee on Energy and Mineral Resources,
Committee on Energy and Natural Resources,
Washington, D.C.

The subcommittee met, pursuant to notice, at 10:05 a.m., in room 3110, Dirksen Office Building, Hon. John W. Warner, presiding.

Present: Senators Warner, Melcher, Matsunaga, and Bradley.

Also present: Roger Sindelar, counsel; D. Michael Harvey, chief counsel for the minority; Benjamin S. Cooper, professional staff member for the minority; and James T. Bruce, counsel for the minority.

OPENING STATEMENT OF HON. JOHN W. WARNER, A U.S. SENATOR FROM THE STATE OF VIRGINIA

Senator Warner. Today marks the second oversight hearing this session on the strategic petroleum reserve. Actions taken by the administration and Congress subsequent to the March 16 oversight hearing on the SPR have increased the attention on and the importance of the reserve.

In times of energy uneasiness which this country faces in the future years, the SPR is one concrete program this country can turn to alleviate any threats of energy cutoffs. Its presence is a signal to both our allies and those that disagree with us that energy will not be this country's Achilles heel that it has been.

Recognizing this vital point, this subcommittee has taken the strong stand that the SPR should be filled as quickly as possible. The full committee has recommended that the fill rate for the reserve be increased 50 percent above what the administration requested in its fiscal year 1983 budget.

Testimony in the last hearing by the Department of Energy of what role the administration envisioned the SPR would play was in the judgment of the Chair and members of the committee inaccurate.

Accordingly, it is our hope today that the DOE would reappear and perhaps we could try to get the vote, we have failed. Therefore we have to act on the record which in the judgment of the members is incomplete.

We have issues remaining on the proper domestic role of the SPR; the role the SPR plays in international energy situations; the need for regional diversification of the SPR; product SPR versus crude SPR; the need for interim storage.

We are fortunate today to have an outstanding group of individuals to provide the committee with insight into those issues and to prepare a record for use in the future.

Does the Senator from Montana have a statement?

STATEMENT OF HON. JOHN MELCHER, A U.S. SENATOR FROM THE STATE OF MONTANA

Senator MELCHER. Thank you, Mr. Chairman. It was of interest to me 10 days or so ago when I drove by the Elk Hills Petroleum Reserve to reflect back on the position we were in several years ago before Congress passed the bill requiring the opening of that reserve to produce as much oil as practical.

The question was asked of me by one of the news media people with me; "why was it necessary"; why was it not wise to just leave that oil in the ground and have it available for national defense when needed. I said the problem was then, and still would be now, if it were in the ground and there was an emergency that we could not get it out from Elk Hills fast enough to be of any significance in that emergency.

The same is true as we discuss the SPR. If we do have an emergency and we would need large quantities of oil for national defense SPR would be the answer, because it would be readily available and could be brought to refineries immediately and put into refined products that would meet the needs of the Armed Forces during a military emergency.

It is a question now, I think, before Congress and the administration as to whether or not this is the proper time to increase the amount of availability of crude oil in SPR. It is true, as I have been told, that the market is soft enough right now in the spot market to allow for purchase of oil at $5 off OPEC prices. It seems to me to make practical business sense to do as much as we can to put crude supplies into SPR to meet any contingency both from the national defense aspect or from the domestic aspect, should there be another shortage of oil.

So I thank the audience in this hearing very kindly and I am anxious to hear what the witnesses have to say and what their best recommendations are for this committee and for Congress.

Senator WARNER. I thank the Senator from Montana and I share your views.

We will start off this morning with Robert D. Hormats, Department of State, Assistant Secretary for Economic and Business Affairs.

STATEMENT OF ROBERT D. HORMATS, ASSISTANT SECRETARY FOR ECONOMIC AND BUSINESS AFFAIRS, DEPARTMENT OF STATE, ACCOMPANIED BY WILLIAM WITTING, OFFICE OF INTERNATIONAL ENERGY POLICY, DEPARTMENT OF STATE

Mr. HORMATS. Mr. Chairman, it has been only 10 months since I last appeared before this subcommittee and appealed for continued support of the strategic petroleum reserve, which I believe—and I think we both share this view—to be fundamental to the energy security of the United States.

In the following months, under your leadership, Congress worked with the administration to establish a new mechanism for funding accelerated SPR oil acquisitions. Purchases have proceeded at a record pace. We have added about 110 million barrels to the reserve in this short period of time.

During the same period the world oil market has softened, bringing with it a risk of complacency and leading some to conclude that the two oil crises of the 1970's cannot be repeated. However, the lesson of the 1970's is that supply interruptions can occur with great suddenness and that a tranquil market one day can be highly disrupted the next.

We cannot assume that a supply crisis will not recur, because if our assumption is wrong and we are ill-prepared, our economy and the world economy will suffer severe harm.

And so my primary message remains today the same as it was 10 months ago: That it is essential that we take advantage of the continuing surplus in oil supplies being offered for sale to fill the SPR as fast as permanent storage becomes available. In this respect, I agree with you, Mr. Chairman and Senator Melcher, that this is a particularly auspicious time for buying because of the weakness in the market.

Let me now address more broadly our international energy policy. A central theme of that policy is the need to reduce the extent to which an interruption of energy imports, particularly oil, could threaten the security and the welfare of the American people. At the same time international energy policy formulation must take into consideration a variety of external problems and interests.

I would offer two quick examples. First, U.S. national security is intertwined with the security of our allies in Western Europe and around the Pacific Basin. This is also true of our energy security. To the extent that our allies face harm from an oil supply disruption, they may find themselves compelled to take such actions as engaging in a rush to acquire scarce oil supplies where only the oil exporters would be the winners. And some may be under heavy pressure to make political deals to secure needed energy supplies, thus weakening our diplomatic efforts.

Second, if the basis of cooperation is laid ahead of time, assistance from these countries might enable the United States to cope with an oil supply crisis more effectively than would be possible relying solely on domestic resources.

It was consideration of factors such as these that led the United States to become a signatory to the agreement on an International Energy Program and to make participation in the International Energy Agency a central element of U.S. International Energy Policy.

As you know, Mr. Chairman, the IEA is unique in providing a forum for consultations on energy matters with most of Western Europe, Canada, Japan, Australia, and New Zealand. These consultations focus on assuring that the efforts of individual members to reduce the threat of oil trade disruptions are mutually reinforcing and that we can collectively avoid oil being used as an instrument of political pressure.

The bond which holds the IEA together is the mutual commitment contained in the IEP that member countries will work in concert in responding to oil supply crises. The IEP established an organizational framework for such responses. Our strategic petroleum reserve has a very important role to play within this framework of cooperation with our IEA partners.

The major policy problem in an oil supply crisis is how to balance demand for oil with available supplies. Solutions can and will vary from economy to economy. Each national government will insist on resolving through its own political processes the problem of apportioning the burdens of this adjustment process among its own citizens.

The IEP recognizes this fact of international life. In defining the obligations of its members, it does not speak of the specific measures they must adopt to correct internal oil supply disequilibria. Rather it seeks only to develop the general principle that its members have an obligation to one another, as interdependent members of a closely-knit international economic community, to prepare for oil supply crises in a way that will permit them to avoid as much as possible making unfair demands on their neighbors in a crisis and to be of some assistance to those neighbors should one or more of them, through no fault of their own, be stricken more severely by the crisis than the rest of the group.

As you know, Mr. Chairman, the IEP treats the second part of this obligation by outlining in substantial detail the structure and operating procedures of an emergency international oil sharing system designed to assure that no member country is subjected to disproportionate hardship by an oil crisis.

By contrast, the IEP treats the first part of the IEA membership obligation in a much more summary way, its only specific requirement being that each country maintain a minimum level of reserve oil stocks to be available for drawdown in a crisis. Each government is left to flesh out the details of its domestic preparedness strategy consistent with its own political requirements.

For purposes of this hearing, our primary concern is with the IEA oil stockpiling requirement. The IEP provides that "each member country shall maintain reserves sufficient to sustain consumption for at least 90 days with no net oil imports."

These reserves may be held by whatever entity or entities, public or private, the individual government chooses, and may include crude oil and petroleum products in whatever proportions the government deems appropriate. Should the IEA emergency system be activated member countries would be expected to begin to release for domestic consumption those stocks held under the 90-day requirement.

The IEP imposes no requirement for export of national stocks under any circumstances, nor does it impose any obligations on the use of any national stocks held in excess of the 90-day requirement.

The U.S. Government attaches great importance to the IEA oil stockpiling requirement. Even with the best of intentions and the most elaborate of international sharing systems, we and our allies will not be able to support one another or take steps to maintain order in the international oil market if we are caught without adequate reserves in a major supply interruption, and price increases and other forms of demand inhibition have to bear the entire burden of restoring balance between oil demand and supply.

By contrast, if IEA countries, together, maintain a sufficiently high level of reserve stocks, the immediate threat which a supply disruption could pose to member-country security and to market stability would diminish significantly.

We, therefore, monitor very closely the stock levels, not only of the United States, but also of our IEA partners. The IEA Secretariat distributes monthly reports on this subject, and stock levels are discussed regularly in meetings of the IEA Governing Board and its working groups.

In general we are pleased with IEA stockpiling efforts. With the exception of two or three of the poorer members, all IEA countries hold stocks at or above the required minimum. As a group, IEA countries, at the end of 1981, held stocks equivalent to 169 days of 1981 imports; 8 of the 19 member countries, who are net importers of oil, held in excess of 150 days of stocks. Taking into account both the SPR and privately held stocks, the United States was one of the IEA leaders, with 246 days of 1981 imports.

In addition, our IEA partners have agreed to begin to raise the minimum stock requirement. At the IEA Governing Board meeting last December, we reached an informal consensus to try not to let national stocks fall below the equivalent of 90 days of 1980, instead of "preceding year," net imports, except where oil consumption has declined because of clearly established long-term structural changes.

This should lead to stock levels higher than those which would exist if the preceding year formula were retained because consumption has fallen in most countries since 1980.

The European Community countries have followed up on that decision by revising the Community stocking requirement to 90 days of 1980 consumption. At a time when recession and unrealistically high oil prices have reduced oil consumption and imports to a level below recent long-term trends, we regard these steps as a reassuring sign of the strength of our IEA partners' commitment to maintaining high levels of oil stocks.

I would also make special note of the stockpiling efforts of Germany and Japan. Germany, with its heavy oil import dependence, has had an oil stockpiling program since 1965. Today stocks held by the German Government, by a special quasi-public corporation and by private companies amount to about 150 days of 1981 imports.

Japan, also heavily reliant on oil imports, while slower in establishing a substantial stockpiling program, has now raised its stocks above the 90-day minimum and has begun development of a Government-owned strategic stockpile. This reserve currently holds over 65 million barrels of oil or about 17 days of Japanese imports.

Plans call for its expansion to about 190 million barrels by 1988. We welcome these efforts, although we are urging Japan to consider measures for accelerating its reserve accumulation rates.

At the same time, we believe that there is room for improvement in the IEA oil stockpiling effort. Here, we believe the performance of the United States in the creation of the strategic petroleum reserve sets a good example. As Bill Vaughan described for you in some detail last week, the United States has taken advantage of recent slack market conditions to expand rapidly the SPR.

It has been suggested that U.S. stock statistics overstate the U.S. reserve position by failing to identify clearly the sizable volume of oil reserves which are required to allow the U.S. refining and transportation system to operate smoothly and which, therefore, are not actually available for use in a crisis.

It is certainly true that a substantial portion of private stocks are available for emergency use, but no one is certain precisely how much. The benefit of SPR oil is that it is unambiguously available for crisis use. It now amounts to more than 40 days of 1980 oil imports.

We will continue to press our IEA partners to redouble their stockpiling efforts. As we have pointed out repeatedly to them, both bilaterally and in the IEA, the rationale for a 750-million-barrel SPR in the United States also argues for them to maintain stockpiles in excess of the 90-day level.

With economic downturn and budget deficits now a common phenomenon among IEA countries, their response thus far has been somewhat reserved. We are hopeful that the recent drop in crude oil prices will give new impetus to IEA oil stockpiling efforts.

In sum, Mr. Chairman, the SPR is essential to our own energy security and we must continue to fill the reserve as fast as permanent storage becomes available. That is fundamentally in our national interest. Beyond that, there is general agreement in the IEA that oil stockpiling is basic to our cooperative strategy for responding to oil crises. We are confident that, as we continue to fill the SPR, more and more of our IEA partners will also find means to expand their participation in stockpiling efforts.

I thank you, Mr. Chairman. I would be delighted to answer any questions.

Senator WARNER. That is a very positive statement. In making this strong case, is SPR large enough for our needs in a crisis? You take the position though that SPR should be filled as fast as permanent storage becomes available. Do you purposely eliminate the option of temporary storage?

Mr. HORMATS. Well, I should tell you, Mr. Chairman, that I had hoped that Mr. Vaughan, or his representative, would be here to answer some of the questions regarding details of the storage program.

Senator MELCHER. We did too.

Mr. HORMATS. My impression is that they are moving as quickly as possible to continue the leaching effort and that that will be the main inhibiting factor over the next several months. When the leaching effort is complete, stocking will again resume at a higher rate sometime in the latter part of the fourth quarter.

I really would not be in a position to answer the detailed questions as to whether, in the interim, it is desirable to store in auxiling facilities.

Senator WARNER. I can understand, that is properly out of your jurisdiction. You did not know we knew the use of that phraseology. S. 1503 contains extension of the IEA. In your opinion, what effect might the detail of S. 1503 have on the IEA program?

Mr. **Hormats**. There is one key element that was addressed in the President's veto message which is of major concern from the international perspective, and that is the question of extending section 252 of the Energy Policy and Conservation Act [EPCA] from an international point of view and, as the President indicated in his statement, it is imperative that that authority be continued in some form as soon as possible, because without it the United States would not be in a position to participate in a coordinated response to an international oil supply disruption. In my judgment, and looking at it from our perspective, that is a critical element. We now need additional legislation to extend EPCA 252.

Senator **Warner**. I will return to questions, at the present time of my colleagues. The Senator from Montana.

Senator **Melcher**. Thank you, Mr. Chairman. Secretary Hormats, having this oil in reserve is akin to having gold in Fort Knox. You make a point that there are 90 days of import supply, I believe, in Japan. Do I understand that correctly or not?

Mr. **Hormats**. Yes; roughly that. The overall Japanese reserves are over 90 days. They are building a special Government reserve which will ultimately hold about half that amount.

Senator **Melcher**. And Germany has 150 days of supply of imported oil?

Mr. **Hormats**. Germany has about 155 days of imported oil.

Senator **Melcher**. And we have about 40 or 45 days of supply equivalent to import.

Mr. **Hormats**. In total, when you add the private and the SPR, there are about 246 days of net 1981 imports.

Senator **Melcher**. But it is not clear, I believe your testimony is to the effect, that it is not clear how that portion of it in private ownership would become available for an emergency.

Mr. **Hormats**. In the event of a supply disruption and the shootup of prices, it is likely that the private sector would sell some of the oil that it held in private stocks. In a supply emergency we would also be in a position to release oil from the SPR.

Senator **Melcher**. But the oil supply in the SPR is currently at about 40 or 45 days or the equivalency of our daily import.

Mr. **Hormats**. Roughly 45 days of 1981 imports; yes.

Senator **Melcher**. Then, I understand you correctly. Now there are budget constraints we have to recognize, and it is unfortunate that we have to view this as some sort of an outgo from the Treasury when, in effect, the actual ownership of it is an asset akin to the gold in Fort Knox. Do you agree with that?

Mr. **Hormats**. And given the way the price of gold has dropped, it may even be better.

Senator **Melcher**. Then, in talking about what Bill Vaughan has said, I am quoting from you as Bill Vaughan described for you, meaning us, in some detail last week, the United States has taken advantage of the recent slack market conditions to expand rapidly the strategic petroleum reserve.

It is my understanding that the United States is not looking for oil contracts at all. Vaughan told the subcommittee that since we now have contracted most of the oil we plan to have delivered to SPR facilities for the remainder of the fiscal year we have temporarily deferred accepting further offers under the continuous open solicitation in view of the OPEC spot price and the "contract" price for OPEC crude.

Mr. **Hormats**. My impression is that the reason that is done is that we have already contracted for the amounts that we could use in filling the SPR for the next couple of quarters.

Senator **Melcher**. Why then should we be leasing what excessive storage there is in the private sector until we have permanent facilities available?

Mr. **Hormats**. As I mentioned to the chairman, one of the things we have not gotten into is the details of exactly how the SPR is filled and the possibilities of auxiliary storage; for instance, ships, or something of that nature.

Senator **Melcher**. Is there not a contradiction here between what you are telling us and what Mr. Vaughan has stated; that we are through buying for the rest of the fiscal year, even though we are advised that there are some opportunities to lease temporarily the space that we would be needing to take advantage of this $5 drop as a part of our crisis?

Mr. **Hormats**. I suspect that would be largely a budgetary question. I think you have raised a key point. We do have the opportunity and we hope we will have slack prices for a period of time to come. But we do have the opportunity now to buy.

I think it would really be sort of a budgetary tradeoff: One, how much money do we have to purchase; two, how much would it cost to lease the available auxiliary storage. In other words, there may be a tradeoff in that while oil prices may be cheaper. Some of that may be offset by the additional price you have to pay for the leasing. And I simply do not know the answer to that. I mean it is a fair question.

Senator **Melcher**. Could we have that answer?

Mr. **Hormats**. Yes.

Senator **Melcher**. It seems to me that the leasing would be an insignificant amount compared to the $5-per-barrel saving.

Mr. **Hormats**. I will put that question to the Department of Energy, which I suspect has done the calculations.

Senator **Melcher**. Will they answer that?

Mr. **Hormats**. I am sure they will.

Senator **Melcher**. Thank you.

Senator **Warner**. Mr. Bradley.

Senator **Bradley**. Thank you very much, Mr. Chairman. Mr. Hormats, could you help the committee understand the rationale for the level of expenditures that the administration has allowed for the purchase of SPR oil within the context of our general economic strategy, international and defense strategy. In other words, how do we make a tradeoff between spending $200 billion, $216 billion on defense, and not really being able to get more than a couple of billion dollars to buy oil to put into reserves?

Could you tell me given the various probable threats that exist around the world to our economic security, how do you balance those two?

Mr. **Hormats**. It is really a judgment, I suspect, that is made largely by the people who have to make these tradeoffs within the budgetary process.

Senator **Bradley**. What do you think as you look at our economics?

Mr. **Hormats**. As you doubtless know, we have been a strong supporter of substantial funding for the strategic petroleum reserve, largely, I think, for the reasons that you have indicated and that I have mentioned in my testimony. One of the major threats to our economy and to our security is an oil supply disruption over the next several years and there is always the possibility that a tranquil market one day can be a disrupted one the next.

I can only answer your question to the effect that, given a relatively tight budget, those who had to make the tradeoff between this element of our national security and the military element of our national security decided that there were a number of programs in the military element which required priority.

Also I think there was a general feeling that the fill rate that was projected, and the ones that are projected here are still adequate to get us to the target of 750 million barrels by 1989.

Senator **Bradley**. As the chairman pointed out in our previous meeting on SPR, as a part of the omnibus reconciliation bill, there was a fill rate figure of 300,000 barrels a day that the adminstration had signed off on, signed off as being necessary and you were part of that agreement.

Mr. **Hormats**. Sure.

Senator **Bradley**. You signed off that 300,000 barrels a day was the appropriate level of fill given our various level of threats and probable disruptions, and you budgeted enough money to fill 200,000 barrels a day. So you are 50 percent off your target. What has changed? And do you feel the Persian Gulf is any more stable today than it was a year ago?

Mr. **Hormats**. Excuse me, I did not hear the last part. I was consulting with my SPR expert here.

Senator **Bradley**. What has changed since the agreement to fill the 300,000 barrels a day signed off by three Cabinet officials and the President and now that the budget projects a fill rate of 200,000 barrels a day? Do you think, my question was, that the Persian Gulf is any more stable today than it was a year ago, when you signed off on it?

Mr. **Hormats**. The answer is "No." I don't think it is any more stable.

Senator **Bradley**. What has changed then?

Mr. Hormats, I can answer you the same way I answered the chairman earlier and that is that the fill rates and the calculations are essentially worked out by our colleagues in the Department of Energy.

Senator **Bradley**. But they are not here today. You are the administration spokesman.

Mr. **Hormats**. I know. I am aware of that. I would like with all due respect to take the question and get back to you with that answer. My impression from the conversations I have had with them on the details of their own fill programs are that they are developing the permanent reserves as rapidly as they can, that there is a slowdown caused by the leaching program over the next several months. Once the leaching program is over they will be back to a higher level.

Senator **Warner**. If the Senator will yield, let me try to reframe that very important question. There may have been many factors that influenced that decision. We are going to find out what it was eventually. Your area of jurisdiction is international. Has there been any change in the international field, in your judgment, that would indicate going to a lower fill rate?

Mr. **Hormats**. The potential for instability in the Middle East and the gulf is virtually the same as it has been over the last several years.

Senator **Warner**. Or even a little worse

Mr. **Hormats**. Or conceivably a little worse, given what is going on in the area.

Senator **Warner**. So if you were sitting around the round table, you would argue the minimum to remain at the 300 or even possibly go higher?

Mr. **Hormats**. Well, I would say, to put it a slightly different way, that the need to continue a substantial fill rate has not changed.

Senator **Warner**. From your perspective.

Mr. **Hormats**. Yes, sir.

Senator **Bradley**. Mr. Chairman. Do you want to respond to us in writing?

Mr. **Hormats**. Yes, sir.

Senator **Bradley**. Will this be your response or will it be DOE's response.

Mr. **Hormats**. I am told that DOE is going to be testifying on the 30th and I will tell them that this question was asked and I will urge them at that point to respond.

Senator **Bradley**. Let me remind you, just for the record here, first of all, there is no hearing on the 30th.

Mr. **Hormats**. I was told by DOE that there was.

Senator **Bradley**. The other point is we have asked DOE these questions before and, in fact, at the February 4 hearing they said they would get back to us in writing. I know the postal service is bad but we have not gotten any communication from them.

Mr. **Hormats**. I will make my best effort to insure that you get a clear answer in writing soon.

Senator **Bradley**. In your testimony you mentioned that you are urging Japan to accelerate its reserve acquisition. What are you doing specifically and what do you envision and how soon?

Mr. **Hormats**. Well, we have had conversations with the Japanese, both bilaterally and in the International Energy Agency, at a meeting of the Governing Board, which I participated in about a month ago. And we have made it clear to Japan that a country which is as vulnerable as Japan clearly has a strong interest in building up its reserves as a first line of defense. We have tried to demonstrate through looking at the numbers that they should continue to increase their reserves.

Senator **Bradley**. What did they say?

Mr. **Hormats**. They are basically supportive of it. I think they, too recognize their vulnerability, which is why they set up this governmental stockpile in the first place. If anything it is not a question of will but a budgetary constraint. But my impression of the Japanese is that they are quite interested in increasing their——

Senator BRADLEY. Would you be opposed to joint stockpiling, United States/Japan; Japan purchase, United States pay the storage facilities.

Mr. HORMATS. Japan would purchase it?

Senator BRADLEY. And store it in U.S.-built facilities somewhere in the Pacific.

Mr. HORMATS. As long as the economics are reasonable, I don't see any problem with that.

Senator BRADLEY. As a possible area of Japan/United States cooperation, you would accept that.

Mr. HORMATS. We had suggested something similar to that in the grain area a few years ago, you probably recall. I would have to take a look at the details—but generally it strikes me that the more we can build up storage capacity and if we do it cooperatively, that is fine, so long as it does not interfere with our own SPR, over which we have full control.

Senator BRADLEY. When the administration files its report to the Congress on May 1, will it continue to adhere in your view to the 750-million-barrel goal of the SPR?

Mr. HORMATS. Yes.

Senator BRADLEY. There is no intention to reduce that goal?

Mr. HORMATS. I am not aware of any intention to reduce it.

Senator BRADLEY. If the IEA extension is not extended by April 1, can the extension be resurrected after that date?

Mr. HORMATS. I believe it can be, yes. You mean the extension of the antitrust authority, the EPCA 252 authority. Yes, it can, except that we would be somewhat vulnerable during the period in which we did not have it.

Senator BRADLEY. When you were responding to the question that the chairman and I posed to you about what has changed in the international oil market or the Persian Gulf specifically to justify a 50 percent less fill rate, could you also answer why we should not be in the spot market now to buy oil?

I mean the point that Senator Melcher made, your testimony said we are purchasing oil; Vaughan said we are purchasing oil. Vaughan told the committee that there are no more oil purchases. The oil that is going into reserve now was purchased last year on contract. You now have oil out there that is available for $5 less than what the contract is. Why should we not be taking advantage of this drop in oil prices and buying up the oil for the reserve?

Mr. HORMATS. As I answered Senator Melcher's question, I would guess——

Senator BRADLEY. You can see no reason why we should not do so?

Mr. HORMATS. There are two reasons which I can conceive of why we might not be doing it. One is the budgetary constraint, and two is the question of whether the amount of money you would pay for the auxiliary storage capacity might not offset the benefit of a lower oil price.

Senator BRADLEY. You have temporary storage and you have committed yourself as the administration to 300,000 barrels a day fill rate. You are basically saving $500,000 a day if you buy on the spot market now.

Mr. HORMATS. Assuming you have an economic place in which to store it. I gather you have some witnesses who will be testifying later as to the economics of that.

Senator BRADLEY. Thank you, Mr. Chairman.

Senator WARNER. Senator Matsunaga.

Senator MATSUNAGA. Thank you, Mr. Chairman. I would like to make an opening statement, if I may, Mr. Chairman.

Senator WARNER. With no objection.

STATEMENT OF HON. SPARK M. MATSUNAGA, A U.S. SENATOR FROM THE STATE OF HAWAII

Senator MATSUNAGA. Mr. Chairman, our hearing has become especially significant today in light of the Presidential veto and the failing of the Senate to override the veto on a meaningful plan for standby petroleum allocation.

I believe it behooves this subcommittee to facilitate action on a viable plan to ensure the attainment of the goals established by the Congress to a full strategic petroleum reserve. In addition, I am of the opinion that the full committee should take the lead in reestablishing jurisdiction over the development of our indigenous energy resources.

The insurance of a strategic petroleum reserve is the purpose of this hearing mainly, and my questions to witnesses will focus on this issue. I will, however, when appropriate, ask for opinions on how we might be able to supplement oil storage activity within the more important task of developing energy self-sufficiency, as we will continue to be vulnerable until we become energy independent.

The vulnerability question is of particular concern to me, since I am from a State completely isolated by 2,500 miles of ocean and importing most of its oil from the organization of petroleum exporting countries. Hawaii last year imported as much oil as it did the year before the 1973 energy crisis.

We in the 50th State remain one Middle East event away from another energy crisis, as does the United States as a whole, as I am sure you will agree. It is true that the high rates of interest and the recent drop in oil prices has led to a rethinking on the part of the private sector in moving ahead with dispatch on the development of our indigenous resources.

It is also true that our extraordinary budgetary situation is forcing the Federal Government to reduce support for energy programs. However, we cannot phase out our fossil and renewal energy programs as has been suggested. We cannot relax in our resolve to fill the strategic petroleum reserve.

We should take advantage of this period of petroleum glut and soft prices and move ahead on interim storage and establishing regional petroleum reserves. Where appropriate and necessary, we should also be storing petroleum products. All of this should be done with the full cooperation, of course, between the Congress and the administration. We should be working together.

The problem I suspect is that there are some who believe that oil is a free market commodity. If there has been an item whose artificiality in pricing has been beyond our control, it is crude oil. We cannot control the supply, we have a relatively constant demand that has not changed much since 1973, and we periodically await the dictates of Middle East oil ministers for the price we will be forced to pay.

The over supply of oil today is only temporary and is nothing more than evidence that the OPEC nations themselves cannot get their act together. My concern is that some of our prominent leaders in both the public and private sectors are expressing the thought that decontrolling the price of oil has created a free market condition which once and for all has eliminated the possibility of another supply dislocation.

The truth is that we have been given a reprieve. How long is this improbable condition to continue? If we are to reap any benefit from past experience we should be doing everything possible to prevent another energy crisis.

Expedited filling of the SPR is one way and the accelerated development of our indigenous, alternative energy resources definitely is another. I fear that we are slowing down on the former and practically giving up on the latter. Surely there is something we can do to turn around this situation and I do not think that letting the free market completely take over is necessarily the solution, because we indeed do not in fact have a free market.

Mr. Chairman, the hearing today should mark the beginning of a series of activities to get us back on track. I thank the chairman for permitting me to make my opening statement.

Senator WARNER. Well, the chairman thanks the ranking minority member for his contribution and insight into these important issues. I share many of the opinions that you have expressed this morning and I recognize the importance to Hawaii on the issue before the subcommittee. Perhaps we should have a hearing in this area on that point.

Senator MATSUNAGA. I was about to suggest that, Mr. Chairman. I am so glad we are thinking on the same track and I certainly appreciate your confidence.

Senator WARNER. Thank you very much, Mr. Secretary. We want to move along with our panel of witnesses.

Senator MELCHER. May I just make two points for the record. In December 1981, the Department of Energy estimated that the cost for storage of a barrel of oil on a weight capacity was 15 cents per barrel per month and $1.80 per year. On March 2 of this year in testimony before this subcommittee on fossil and synthetic fuels in the House and on March 2 of this year, a representative of the Independent Fuel Terminal Operators Association cited the figure of $2 per barrel per year as the rate at which members of the association would be willing to lease space for storage.

Senator WARNER. Thank you, Senator, from Montana.

Mr. Secretary, the distinguished Senator from Hawaii has a question.

Senator MATSUNAGA. Mr. Secretary, last week Dr. Randall Holcomb of Auburn University made some interesting, if not controversial, remarks about the soundness and integrity of the SPR. The viewpoint expressed was that by spending the money on SPR we are not making a significant effort to develop the productive capacity of domestic energy industry. That is, we are making very little long-term additions to our energy supply.

Dr. Holcombe may well be correct, for the administrative budget request for the development of our indigenous energy resources have dropped dramatically between fiscal year 1981 and 1983. Specifically, the renewable energy funding dropped from $500 million to $72 million and that for the fossil fuels declined from nearly a billion dollars to a mere $100 million.

Are we leaving the development of our alternative energy resources in a state of benign neglect or do you have any reason to feel that the administration has any reason to believe that the private sector will take up the slack?

Mr. HORMATS. Well, there have been, as you correctly point out, Senator, a number of budgetary cuts in some of the new areas of energy, synfuels, for instance. But there are some major projects which are still going on and I think that one thing that has also occurred is that drilling in the United States has been going on at a very vigorous rate and indeed has increased. Natural gas exploration is increasing.

There has been a lot of new exploration going on in the northern slope and the Beaufort Sea in part because of decontrol and in part because this Congress in its wisdom passed the waivers for the Alaskan natural gas pipeline.

So I think that there have been a number of very optimistic aspects to the energy outlook since decontrol and since the congressional decision on the pipeline. So I think that while some projects that were contemplated are now getting less Government support, there has been a notable increase in some areas of the private sector expenditure, which I think gives us a considerable amount of hope for the future.

I would say, however, that, whatever happens with respect to new production, we still need a very substantial strategic petroleum reserve, as I am sure you would agree. And I think that that really is important even if domestic production does go up, because we still need that vulnerability insurance.

Senator MATSUNAGA. Of course, this is a matter within the jurisdiction of the Finance Committee, of which I am also a member, but other than a tax incentive for the development of alternative renewal energy, what can the administration do to encourage the Government in the development of alternative energy sources?

Mr. HORMATS. Well, there are still a number of programs, as you know, that are going on now that provide for Government involvement in such things as synfuels and in other renewable or new types of energy resources.

A a result of the budgetary cuts and of some assessments made as to the efficiency of some of these projects and the likely cost outlook, a number of them were in fact cut, but I don't think this means that the Government has completely removed itself from the area of new energy resources.

It has, however, in large part on account of of budgetary constraints, been playing a smaller financial role.

Senator MATSUNAGA. One last question, Mr. Secretary. Inasmuch as you are in charge of economic and business affairs, is long-term leasing of storage facilities for crude oil and products from the private sector a viable supplement to storing oil in salt domes?

Mr. HORMATS. As I mentioned in response to Senator Bradley's question earlier, this is a question that we, the Department of State, have really not had to get very deeply involved in. I suspect it is both a question of budgetary constraints and a question of the economics, whether there is a greater benefit, whether it is economic to in effect buy the oil at a soft price today and store it in an auxiliary storage facility or not to buy.

It seems to me that is partly a budgetary question and partly an economic question and I simply do not know enough about the economics of the two alternatives to give you an answer. But as I promised Senator Bradley we would speak with our colleagues and OMB and try to get a clear answer. I also think you will probably benefit from some of the subsequent witnesses who perhaps have done more economic analysis than I have.

Senator MATSUNAGA. Do you think that you will be making studies in this area?

Mr. HORMATS. I think that the Department of Energy has done a good deal of work in this area, detailed work, but I don't have it at hand.

Senator MATSUNAGA. I would think that the administration ought to get its act together and know what the right hand is doing, the right hand should know what the left hand is doing.

Mr. HORMATS. With respect to this particular issue, the State Department is neither the right nor the left hand. This is done largely between OMB and the Department of Energy. And as I had mentioned I had hoped someone from the Department of Energy might be able to be here to provide that information, but I assure you that I will speak to them immediately after this hearing and suggest that they do so.

Senator WARNER. Thank you. Senator Bradley.

Senator BRADLEY. Mr. Chairman, I just want to echo what the Senator from Hawaii said. Mr. Hormats is always an outstanding witness and very forthcoming, but as the point has been made a number of times today, he is not the primary official in administration responsible. And frankly I am distressed there is no representative here from the Department of Energy.

I hope that you are going to use your full power to make sure that there is another hearing at which we do have a representative from the Department of Energy. They are stonewalling this issue. They don't answer our questions. We have submitted questions in writing and they have not answered the questions in writing.

I mean how are we supposed to have oversight responsibility if we do not have cooperation from the people who are charged to execute the policy?

Senator WARNER. The Senator's viewpoints are well taken. I share them. We thank you, Mr. Secretary. You have addressed your area of expertise explicitly and we know exactly where you and your Department stand.

Mr. HORMATS. Thank you, Mr. Chairman.

Senator WARNER. For the benefit of the members and others, I must leave at 5 minutes to 12 to chair another committee meeting.

And I will resume this hearing at 1:30, to give each and every witness a full and adequate opportunity to present their testimony.

I would like to move along as expeditiously as possible. The next testimony is by Mr. John Lichtblau, president, Petroleum Industry Research Foundation, Inc., New York, N.Y.

Mr. Lichtblau, you are well-known to the committee and highly respected. We are delighted you came down to provide us with your insight.

STATEMENT OF JOHN H. LICHTBLAU, PRESIDENT, PETROLEUM INDUSTRY RESEARCH FOUNDATION, INC., NEW YORK, N.Y.

Mr. Lichtblau. Thank you, Mr. Chairman. Thank you for inviting me to testify at this hearing.

As you know, I testified on the subject of the SPR very recently before the House Committee on Energy and Commerce. Since neither my views nor the underlying facts have changed since then, I would, with your permission, like to begin my testimony with a very brief summary of my remarks at the recent House hearing.

I expressed the view that the filling of the SPR should be treated as a high priority national security measure. In fact, I said it was much more likely that international events affecting our security might require utilization of the SPR than use of the highly sophisticated, high cost military equipment we are currently constructing.

I believe therefore that the SPR should be filled at a rate as close as possible to the 300,000 barrels a day target indicated by Congress. Neither physical limitations in the Government's underground storage facilities nor budget considerations should cause the fill rate to drop significantly below this 300,000 barrels a day of target.

Under present administration plans, the planned fill rate for the period from January 1, 1982 to September 30, 1983, will drop to only 172,000 barrels a day compared to nearly 300,000 in fiscal year 1981.

I suggested at the hearing that to the extent that available SPR underground storage capacity was causing a temporary bottleneck in attaining the target fill rate, the DOE should make use of leased tankers, steel tanks, and privately owned underground storage facilities. All of these have currently substantial excess capacity and are therefore available at relatively depressed prices.

I estimated that over a period of time about 100 million barrels of oil could be temporarily stored in this manner. This would mean that the attainment of 500 million barrels storage level, about twice the current level, could be advanced from late 1986 to mid or early 1984.

From the point of view of national security this would be a significant contribution. I pointed out in this connection that in view of our declining oil import requirements, we may find that by 1984 an SPR level of 500 million or 550 million barrels, rather than our present ultimate target of 750 million barrels may be sufficient to cope with most realistic oil interruption scenarios.

This ends the summary of my House testimony. With your permission, Mr. Chairman, I would like to submit the entire House testimony into the record.

Senator WARNER. Without objection.

Mr. LICHTBLAU. Thank you. I would now like to make some additional points. First, the need to fill the SPR as rapidly as possible has taken on new urgency since the President's veto of the Standby Petroleum Allocation Act. The veto has effectively elevated the SPR from one important element in our overall energy emergency response plan to our sole crisis response mechanism.

I would have preferred to have both the rapid fill of the SPR and the standby control authority, and I am not alone in my view, as this committee is acutely aware.

Among the possible consequences of not having standby authority are the following: One, the irresistible pressure to pass legislation at the height of a crisis mandating controls. Such legislation hastily drawn is likely to be more rigid than the vetoed standby authority. The resulting controls are likely to use a firefighting technique rather than the cohesive, carefully considered system necessary to minimize adverse impacts.

Second, the passage of individual State laws designed to deal with energy emergencies. These laws by definition will be serving the interests of the States which pass them and are likely to conflict with the interests or laws of other States.

Under S. 1503 such State laws would have been preempted by Federal legislation. Thus, I would therefore say the absence of one flexible, Federal standby law on this matter could well lead to the enactment of dozens of rigid State laws.

Finally, on this point, the President's insistence that market forces could cope with most likely oil supply interruptions by adjusting demand to available supply could cause major economic distortions and dislocations. If the adjustment required a significant reduction in demand, oil prices would have to rise very steeply, given oil's known very low short-term price elasticity of demand.

Since in the absence of any legislation the oil companies would have to become the enforcement and, hence, collection agencies for this adjustment, their earnings could soar dramatically during such periods. This accumulation of funds in the hands of a single industry under these circumstances is likely to be politically unacceptable and economically untenable.

It has been recognized to some extent by the oil industry in the National Petroleum Council report on this subject.

My next point is a brief elaboration of the comments I made in my earlier testimony on the cost of storing oil in tankers. We had estimated the total annual cost for tanker storage at $3 a barrel. These estimates were for tanker storage at $3 a barrel. These estimates were made last year and tanker chartering rates have come down since then.

More important, our figure did not reflect market quotations but full cost, including interest and capital repayment. Actually in the present tanker market one can readily charter large ships from $1.80 to $1.20 per barrel annually with the rate varying inversely with the tonnage size.

These ships would probably operate at a minimal positive cash flow at such rates. However, the alternative, laying the ships up while keeping them in operating condition results in a net cash loss. It is estimated that some 50 such ships are currently idle and available.

Given the current worldwide reduction in floating storage at this time this number can be expected to increase. Thus, if staggered over a period of time, say, 1 year, it may be possible under current and near-term tanker market conditions to obtain enough annual charters to store some 30–35 million barrels of SPR oil in this manner without any significant impact on charter rates.

These tankers would probably be anchored mostly in the Caribbean or gulf coast, would also add considerable flexibility to the SPR delivery system, because they would permit immediate crude oil deliveries to coastal and U.S. offshore refineries which are not connected to the SPR underground storage system.

For this reason it might even be worth considering the possibility of keeping some SPR oil permanently stored in tankers.

Another point on which I would like to elaborate briefly is the storage of refined products. The U.S. east coast currently depends on imports for about half of its residual fuel oil supply. Last year these imports amounted to 565,000 barrels a day. If a large part of these imports became unavailable it would be very difficult for U.S. gulf coast refiners to make up the difference considering that their total current output of this product is only about 500,000 barrels a day.

The DOE should therefore give serious consideration to the possibility of storing some volume of this particular product at east coast market locations as part of the SPR program. I might point out that at current prices residual fuel oil is probably at the historic low relative to the cost of the crude oil from which it is made.

In conclusion, I would like to point out that the lower fill rate now at issue is less a result of DOE's budge constraints than of the salt cavern capacity constraints and DOE's reluctance to contract for interim storage.

According to our estimates, DOE's purchases of oil from funds already appropriated or requested for the SPR could support a fill rate of some 260,000 barrels a day in fiscal 1982 and 1983, instead of the average of slightly under 200,000 barrels now projected.

Therefore with a relatively small increment to the funding level just to cover the cost of interim storage facilities, we could have nearly 50 million barrels more oil in storage by the end of fiscal 1983. With a larger funding increment, to cover the cost of purchasing more oil as well as storing it in interim facilities, we could be even further along in reaching our often-delayed goal of filling the SPR.

Thank you, Mr. Chairman. That concludes my statement. I would like to answer any questions you have.

[The prepared statements of Mr. Lichtblau follow:]

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Statement before the

Subcommittee on Energy and Mineral Resources

of the

United States Senate

Committee on Energy and Natural Resources

at the

Oversight Hearing on the
Strategic Petroleum Reserve

by

John H. Lichtblau
President

March 25, 1982

I wish to thank you for inviting me to testify at this Oversight Hearing on the U.S. Strategic Petroleum Reserve (SPR).

As you may know, I testified on the subject of the SPR very recently before the House Committee on Energy and Commerce. Since neither my views nor the underlying facts have changed since then, I would like to begin my testimony with a brief summary of my remarks at the House hearing.

I expressed the view that the filling of the SPR should be treated as a high priority national security measure. In fact, I said, it was much more likely that international events affecting our security might require utilization of the SPR than use of the highly sophisticated, high cost military equipment we are currently constructing.

I believe therefore that the SPR should be filled at a rate as close as possible to the 300,000 B/D target indicated by Congress. Neither physical limitations in the government's underground storage facilities nor budget considerations should cause the fill rate to drop significantly below this 300,000 B/D target. Yet, under present Administration plans, the planned fill rate for the period from January 1, 1982 to the end of the next fiscal year (September 30, 1983) will drop to only 172,000 B/D, compared to nearly 300,000 in fiscal year 1981.

I suggested that to the extent that available SPR underground storage capacity was causing a temporary bottleneck in attaining the target fill rate, the DOE should make use of leased tankers, steel tanks and privately owned underground storage facilities. All of these have currently substantial excess capacity and are therefore available at relatively depressed prices. I estimated that over a period of time on the order of 100 million barrels of oil could be temporarily stored in this manner. This would mean that the attainment of a 500 million barrels storage level (about twice the current level) could be advanced from late 1986 to mid-1984. From the point of view of national security this would be a significant contribution. I pointed out in this connection that in view of our declining oil import requirements, we may find by 1984 that an SPR level of 500-550 million barrels, rather than our present ultimate target of 750 million barrels, is sufficient to cope with most realistic oil interruption scenarios.

This ends the summary of my House testimony. With your permission, Mr. Chairman, I would like to submit the entire testimony into the record of this Hearing.

I would now like to make some additional points. The need to fill the SPR as rapidly as possible has taken on new urgency since the President's veto of S. 1503, the "Standby Petroleum Allocation Act." The veto has effectively elevated the SPR from one important element in our overall energy emergency response plan to our sole crisis response mechanism. I would have preferred to have both the rapid fill of the SPR and the standby control authority, and I am not alone in my view, as this Commmittee is acutely aware.

In its report, "Emergency Preparedness for Interruption of Petroleum Imports into the United States," the National Petroleum Council stated,

> "that the government's overall strategy for emergency management of oil import disruptions should be to rely to the maximum extent on market mechanisms, but to have available a variety of emergency standby options of increasing severity to deal with shortages of increasing magnitude."

Among the possible consequences of not having standby authority in place are:

(1) The irresistable pressure to pass legislation, at the height of a crisis, mandating controls. Such legislation, hastily drawn, is likely to be more rigid than the vetoed standby authority. The resulting controls, rashly implemented, are likely to use a "firefighting" technique rather than the cohesive, carefully considered system necessary to minimize adverse impacts.

(2) The passage of individual state laws designed to deal with energy emergencies. These laws, by definition, will be serving the interests of the states which pass them and are likely to conflict with the interests or laws of other states. This crazy quilt of regulations will lead to inefficiency and inequity, the opposite of the Administration's goals. Under S. 1503 such state laws would have been preempted by federal

legislation. Thus, the absence of one flexible, federal stand-by law on this matter could well lead to the enactment of dozens of rigid state laws.

(3) The President's insistence that market forces could cope with most likely oil supply interruptions by adjusting demand to available supply could cause major economic distortions and dislocations. If the adjustment required a significant reduction in demand, oil prices would have to rise quite steeply, given oil's known very low short-term price elasticity of demand. Since in the absence of any legislation the oil companies would have to become the enforcement and, hence, collection agencies for this adjustment, their earnings could soar dramatically during such periods. This accumulation of funds in the hands of a single industry under these circumstances is likely to be politically unacceptable and economically untenable.

My next point is a brief elaboration of the comments I made in my earlier testimony on the cost of storing oil in tankers. We had estimated the total annual cost for tanker at $3.00/Bbl. These estimates were made last year and tanker chartering rates have come down since then. More important, our figure did not reflect market quotations but full cost, including interest and capital repayment. Actually, in the present tanker market one can readily charter large ships (VLCC's and ULCC's) from a $1.80 to $1.20/Bbl annually, with the rate varying inversely with the tonnage size. These ships would probably operate at a minimal positive cash flow at such rates. The alternative, laying the ships up while keeping them in operating condition results in a cash loss. It is estimated that some 50 such ships are currently idle, and available, including, I understand, the world's largest tanker, "Seawise Giant," which has a carrying capacity of 4 million barrels. Given the current worldwide reduction in floating storage, this number can be expected to increase. Thus, if staggered over a period of time, say, one year, it may be possible under current and near term tanker market conditions to obtain enough annual charters to store some 30-35 million barrels of SPR oil in this manner without any significant impact on charter rates.

The tankers which would probably be anchored mostly in the Caribbean or Gulf Coast would also add considerable flexibility to the SPR delivery system because they would permit immediate crude oil deliveries to coastal refineries not connected to the SPR underground storage system. For this reason it might even be worth considering the possibility of keeping some SPR oil permanently stored in tankers.

Another point on which I would like to elaborate briefly is the storage of refined products. The U.S. East Coast currently depends on imports for about half of its residual fuel oil supply. Last year these imports amounted to 565,000 B/D. If a large part of these imports became unavailable it would be very difficult for U.S. Gulf Coast refiners to make up the difference considering that their total current output of this product is only about 500,000 B/D. The DOE should therefore give serious consideration to the possibility of storing some volume of this particular product at East Coast market locations as part of the SPR program. Current prices of this product are probably at a historic low relative to the cost of the crude oil from which it is made.

In conclusion, I would like to point out that the lower fill rate now at issue is less a result of DOE's budget constraints than of the salt cavern capacity constraints and DOE's reluctance to contract for interim storage. According to our estimates, DOE's purchases of oil from funds already appropriated or requested for the SPR could support a fill rate of some 260 M B/D in FY '82 and '83, instead of the average rate of slightly under 200 M B/D now projected. Therefore, with a relatively small increment to the funding level, just to cover the cost of interim storage facilities, we could have nearly 50 million barrels more oil in storage by the end of Fiscal 1983. With a larger funding increment, to cover the cost of purchasing more oil as well as storing it in interim facilities, we could be even further along in reaching our often-delayed goal of filling the SPR.

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Statement before the
Subcommittee on Fossil and Synthetic Fuels
of the
U.S. House of Representatives
Committee on Energy and Commerce

Hearings On
The Strategic Petroleum Reserve
by

John H. Lichtblau
President

March 2, 1982

I wish to thank you for inviting me to testify before your Subcommittee on the subject of the fill rate of the U.S. Strategic Petroleum Reserve (SPR).

At present, two laws affect this fill rate. Under the Energy Security Act of 1980 the President is required to fill the SPR at a rate of at least 100,000 B/D per fiscal year until the ceiling of 750 million is reached. Under the Omnibus Budget Reconciliation Act of 1981 the President is required to seek to fill the SPR at a rate of at least 300,000 B/D. Thus the President has a rigid floor, an open-ended ceiling and a sense-of-Congress indication of a desirable fill rate.

In fiscal year 1981 (as well as in the calender year 1981) the fill rate was very close to the 300,000 B/D target indicated by Congress. In fiscal year 1982 it will be only 185,000 B/D, and in fiscal year 1983, 209,000 B/D, according to the Administration's budget. Since the fill rate was exceptionally large in the last quarter of the calendar year 1981, the presently planned rate for the 21-month period January 1, 1982-September 30, 1983 will be 172,000 B/D. This was indirectly confirmed recently by Deputy Secretary of Energy Davis who estimated the SPR would contain 340 million barrels by the end of fiscal year 1983.

Thus, for this year and next, and probably also 1984, the SPR is scheduled to be filled at a rate well in excess of the required minimum but substantially below the target considered desirable by Congress.

The question is, should we be reassured by the steady progress in the growth of the SPR or should we be alarmed at the scheduled sharp reduction in its fill rate, relative to last year.

In answering this question let us step back a bit. In early 1977 the Administration set an SPR target of 500 million barrels for the end of 1980. Under the currently scheduled fill rate we will not reach that target until 6 years later, at the earliest. Yet, throughout that period, and probably into the 1990's, we will have oil import requirements of at least 5.0 million B/D, equal to about one-third of our total oil supplies. While this is a substantial improvement from the level of oil import dependency in the second half of the 1970's, it means that foreign oil will continue to play an important role in meeting U.S. energy requirements for the foreseeable future.

It may be worth pointing out in this connection that the demand for those oil products which can be most easily replaced by other energy sources, primarily residual fuel oil, is declining both in volume and as a share of total oil demand. At the same time the current excess domestic natural gas producing capacity is likely to disappear within the next few years. Thus, the ability to switch from oil to another fuel at short notice if this should become necessary due to an oil import interruption is declining.

How likely is it that foreign oil will become unavailable in significant volume? Obviously, nobody has an answer to this question. But it is useful to point out that the actual number of significant foreign oil interruptions in the last 30 years is much higher than the two--1973/4 and 1979--that one generally associates with this type of event. The 17-month old Iranian-Iraqi war, which is generally considered to have had almost no impact on world oil supplies up to now, was actually the principal factor underlying the OPEC price increases at the group's December 1980 meeting. Furthermore, if that war had broken out anytime in the 1970's or six months earlier than it did in 1980 it would have had a major impact on world oil supplies.

Other oil interruptions included the Saudi TAP Line breakdown and simultaneous sharp reduction in Libyan oil production in 1971, the Suez Canal closures in 1967 and 1956, the Nigerian civil war in 1967/8 and the consequences of the Iranian oil nationalization of 1953. The majority of these interruptions had only a very limited effect on world oil supplies. But their historic frequency is something that should be kept in mind in speculating on the odds for another interruption. All we really know is that it is the kind of event which has occurred repeatedly in recent history.

Thus, as we have said in earlier Congressional testimonies on this subject, the SPR must be considered a high priority national security measure. The same conclusion has been reached in the recent House-Senate Conference Report on the Standby Petroleum Allocation Act of 1982, as well as in the National Petroleum Council's 1981 report,"Emergency Preparedness..." In fact, there is probably a higher possibility that the SPR will actually be needed than that the highly sophisticated high cost military equipment included in the current budget will be.

Once we accept this concept of the nature of the SPR it becomes clear that we must attempt to reach the already much delayed 500 million barrels target as rapidly as possible. For until the SPR contains at least that much oil it will not be an adequate instrument to deter a substantial oil interruption, and its usefulness in offsetting a large interruption for any length of time will be compromised.

Perhaps we can do with a smaller Phase III capacity than is currently contemplated, although it is still too early to make this decision. But we urgently do need the completion of Phase II which will bring total SPR capacity to 538 million barrels. Then, why the scheduled slow-down in the fill rate? The official reason is that there is not enough salt dome capacity available to fill the SPR at a faster rate than is currently planned. Because of this limitation, the Administration apparently intends to delay the delivery of oil contracted for this year until the next fiscal year. This spillover then exacerbates the constraints on the FY 83 fill rate. Thus, the proposed FY 83 budget for SPR oil acquisition and transportation has been cut by $1.6 billion, or 44%, below this year's budget.

The Administration's justification for reducing SPR purchases is of course correct, as far as it goes. But it does not go far enough. If the Phase II SPR storage facilities are not ready, the oil can be temporarily put in existing tanks, tankers or privately owned underground storage facilities. In the current market of declining demand and declining inventory levels, all of these facilities can be leased for limited periods, probably at relatively low cost.

Take the use of tankers as an example. It is widely practiced in the oil industry and also by the government of Japan which uses tankers for all its emergency stocks. Currently the latter amount to approximately 65 million barrels. Worldwide, there are 85 tankers currently dedicated to floating storage for varying lengths of time, including the 35 in Japan, according to one shipping industry publication. The total capacity of these vessels is 20 million deadweight tons (dwt), down from a late 1981 peak of nearly 24 million dwt. The tankers used for floating oil storage are mostly the Very Large Crude Carriers (VLCC's). The average size of these ships is about 270,000 dwt which gives them a crude oil carrying capacity of some 2 million barrels. With some 60 million dwt of VLCC capacity currently reported to be in surplus, the Administration could readily lease tankers to augment storage capacity in the short-term. Making reasonable assumptions of manning requirements, fuel needs, etc., one can construct a total cost estimate for such storage of about $3.00/Bbl/year.*

Other temporary storage facilities could include the 20-30 million barrels of privately held underground storage capacity at the Gulf Coast. Another possibility is the tanks formerly used for operating storage at refineries which have shut down. Estimates of the number of refineries which have been shut down vary, but the American Petroleum Institute has identified some 3 million B/D of crude oil distillation capacity which was closed as of Septemer 30, 1981. Some of this capacity was shut down only temporarily, but we know that many refineries have ceased operation altogether. The adjunct crude oil storage capability at these facilities is of course a multiple of the refinery's daily throughput capacity; on average, U.S. refineries have the ability to store some 11 days' worth of design crude oil capacity, according to DOE figures. Additional capacity exists for product storage at refineries. Further, marketing companies, faced with contracting demand, may have storage capability which could be made available. In this connection it may be worth looking into the possibility of storing some residual fuel oil at East Coast locations, since most East Coast residual is imported.

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*Specific bids from tanker owners, of course, could vary substantially from this estimate and from each other, depending on alternative opportunities for particular vessels as well as the vicissitudes of the VLCC market.

Altogether, it should be quite possible to find temporary storage for 50 million barrels, and probably as much as 100 million barrels. If this is done speedily and resolutely it could advance the attainment of the 500 million barrel target from late 1986 to mid-1984. From the point of view of national security, this could be considered a significant contribution.

A further argument for augmenting storage capacity now is the much-touted oil glut. We needn't speculate on whether OPEC will be able to maintain its grip on world oil pricing or whether the current oversupply will continue throughout 1982. Rather, we need only to observe that spot crude oil prices are well below official sales prices and that domestic crude oil postings have fallen well below foreign prices. In this market, we know that we could buy additional volumes for the SPR from a number of sources, with an imperceptible effect on the overall level of prices. Given the importance of a large SPR, I would submit that we cannot forego the purchase opportunity which the world market currently affords, short-term budget constraints notwithstanding.

We believe the Administration should make every effort to secure this storage and consequently should not reduce its FY 1983 oil purchasing budget from this year's level. However, I would like to point out that even with a somewhat reduced budget for oil purchases, the 300,000 B/D fill rate could be approximated if temporary alternate storage facilities are developed for storing the oil volumes already contracted for under the existing program or expected to be contracted for in FY 83.

Senator WARNER. I think you made it very clear. The only thing I would like to ask about is tankers. Going back to the DOE testimony in the interim temporary storage, there is not only the cost but security. What is your viewpoint on the security situation in tanker storage?

Mr. LICHTBLAU. Well, there is no problem as far as I can see in the security situation. These tankers would be obviously under U.S. control. They would be anchored either in U.S. offshore waters or in Caribbean waters, so that I don't see why these under any imaginable type of oil interruption would not be available to us and under our control.

Obviously if we have a major war things would change, but then everything would change under those conditions.

Senator WARNER. Your observations are correct. Senator Matsunaga.

Senator MATSUNAGA. Thank you, Mr. Chairman. Now your estimate of an additional 50 million barrels purchase for storage under the present funding, is that estimate based on a projected further decline in the price or oil or at its present price?

Mr. LICHTBLAU. No, sir. It is based on the amount of oil already purchased or contracted for by the DOE, which, however, is not being brought in physically because of the constraints of the SPR. If this oil were brought in or were put in temporary storage facilities the present budget would permit us to put in another 50 million barrels over the 1982-83 fiscal period.

It has nothing to do with the price of oil. It is oil already either committed for or purchased by the DOE.

Senator MATSUNAGA. Now, you say the current prices are at a historic low relative to the cost of crude oil.

Mr. LICHTBLAU. For residual fuel oil; yes, sir.

Senator MATSUNAGA. Residual fuel. Now, do you estimate the present cost to continue on into the rest of this year or the next year or what do you project? Will the price be going up or down and if so when?

Mr. LICHTBLAU. Yes, sir. I don't see under any normal circumstance, absent a major unexpected oil interruption, it would have to be a major one, absent that I don't see any way oil prices can rise, not only in real terms but also in nominal dollars.

Oil prices have declined substantially in the last 12 months and the situation may continue. The present price may continue. You may possibly see a modest further decline and perhaps a slight increase toward the end of the year. But by in large oil prices, in my opinion, will approximately stablize where they are at present.

Because I think we must assume that the annual meeting of the OPEC nations has at least made an attempt to stablize the world supply demand situation. If that agreement should fall apart, which is possible, you may see oil prices declining further. If it does not fall apart prices will approximately hold where they are in nominal terms. Which means in real terms, of course, it will continue to decline for the next year or two.

Senator WARNER. Senator Bradley.

Senator BRADLEY. Thank you, Mr. Chairman. Mr. Lichtblau, in your statement you said 550 million barrels of storage might be sufficient as opposed to the 750 million goal. Why did you say that?

Mr. **Lichtblau**. Well, sir, in the first place the word might is a very important one in that sentence. As we move toward 1984 we will see somewhat clearer what our level of import dependency will be. It has declined dramatically in the last few years, from 8.5 million barrels a day to something like 5.5 million barrels a day.

If we only need, let us say, 5 million barrels a day of imports in the mideighties, which is a possibility, then I think the 750 million barrels a day may be too high because they were clearly based on the assumption of a 7- or 8-million barrel-a-day import level. So we would then be able to adjust our storage requirement to the much lower import level.

Senator **Bradley**. What is your rationale? You get the same number of days protection for less storage.

Mr. **Lichtblau**. Approximately you would, yes, sir.

Senator **Bradley**. What is the magic number about, what, a 100 days? Why are we better off with a 120 days or a 150 days?

Mr. **Lichtblau**. You could say in principle the more oil you have in storage the better off you are. But I am told there are budget limitations in principle.

Senator **Bradley**. And priority limitations.

Mr. **Lichtblau**. Yes, there are also priority limitations. If you assume an oil interruption that is not substantially in excess of, let us say, 2 million barrels a day, which is quite an interruption for the United States, it would mean a world interruption three or four times as high. If you had 550 million barrels in storage you probably could draw down for 7 or 8 months.

I am not advocating that we lower our target. I am just saying in light of our unexpectedly lower import requirement compared to what we assumed when the 750-million barrels target was decided on, we may want a year or two from now to look again whether we really need to go all the way up to 750. But it is too early.

Senator **Bradley**. So you would spend the money now to buy the oil and get it up to 550 as quickly as possible and extend the storage capacity even if that meant going to interim storage?

Mr. **Lichtblau**. Absolutely.

Senator **Bradley**. You said that you felt there were 100 million barrels of storage out there. Now, I have seen some figures that would say you are low.

Mr. **Lichtblau**. I would agree with that. This is a conservative figure. You probably could get more over a period of time. If you try to get too much too quickly you could drive up the rates, but I would think this is on the conservative side.

Senator **Bradley**. What would you say the range of cost of storage per barrel per year?

Mr. **Lichtblau**. Probably in the $2 area, roughly.

Senator **Bradley**. So that you are saying for an investment of $500 million you could get another 250 million barrels of storage?

Mr. **Lichtblau**. Yes, sir, which would then put us to the level which I think is necessary. I believe that below 500 million barrels our SPR is inadequate to deal with any significant sustained oil interruption.

Senator **Bradley**. You have come out strongly for regional storage here. Right?

Mr. LICHTBLAU. Yes. I think it is desirable at the east coast to have residual fuel oil storage, because it is a unique situation.

Senator BRADLEY. Probably we should have it in Hawaii too.

Mr. LICHTBLAU. Yes, sir, we definitely should. Had I known you were here, I would have put it in here.

Senator BRADLEY. And your argument is that we should be storing residual oil now?

Mr. LICHTBLAU. Yes, sir.

Senator BRADLEY. Because of the low price?

Mr. LICHTBLAU. Primarily because the U.S. east coast is so heavily dependent on foreign residual fuel oil. There is no other area in the country that has this kind of dependency.

Senator BRADLEY. Would that help our refineries too? In other words, if we are operating at 60-63 percent capacity, would we be able to operate at a higher capacity if we were storing residual fuel oil?

Mr. LICHTBLAU. We might if you buy domestic residual fuel oil for that purpose.

Senator BRADLEY. Would that help us? That is not going to happen overnight. It is not going to go from 63 to 85. It will take some time, will it not?

Mr. LICHTBLAU. I do not think it would do anything like it. If we needed some additional residual fuel oil for storage purposes at the east coast, it would have a very marginal positive effect on gulf coast refiners. But it would help directionally, it would help them. But it would not greatly increase their refinery situation.

Senator BRADLEY. Do you think other nations view our commitment to the SPR with less conviction today because we are not filling it at the mandated rate?

Mr. LICHTBLAU. Well, it all depends. Some nations probably would never get anywhere with it. Now that we have 250 million barrels they are beginning to be impressed that we even got where we are. For a long time we talked about the SPR and there was nothing in there. After all this was a discussion that had been underway since 1973 and before 1980 it was virtually empty.

So the fact that we purchased 300,000 barrels a day, or almost that much last year, is impressive. But the decline in the purchase in 1982 again raises doubts in the minds of some other countries.

Senator BRADLEY. And it defeats our own intention of trying to get them to increase their storage capacity?

Mr. LICHTBLAU. Yes, it does clearly.

Senator BRADLEY. In your reaction to the veto of S. 1503, you said that you would expect major market dislocations. Why?

Mr. LICHTBLAU. In a major——

Senator BRADLEY. Why can't the market move the oil to wherever they need it the fastest?

Mr. LICHTBLAU. Well, the market can do anything, given the right price, but the right price in a major dislocation may be unacceptable for the economy.

Senator BRADLEY. One other thing happens when there is a major dislocation and price rises. That is Government revenues increase.

Mr. LICHTBLAU. Yes.

Senator **Bradley**. What if those revenues were recycled back to the populous given the means to pay the higher price?

Mr. **Lichtblau**. Well, that would be—you would require legislation for that.

Senator **Bradley**. I understand that.

Mr. **Lichtblau**. That would be a way of solving it possibly.

Senator **Bradley**. In other words, you are concerned about economic dislocation——

Mr. **Lichtblau**. Yes.

Senator's **Bradley**. Would be eliminated if we could provide the purchase power to consumers.

Mr. **Lichtblau**. This is a controversial issue, but it would be one way of dealing with the accumulation of funds in the hands of the industry.

Senator **Bradley**. So you are saying that the present circumstance is unacceptable in the sense that there probably could be economic dislocation, but an improvement on the present circumstance, maybe not the best in your view, but an improvement would be to try to get purchasing power back to individuals.

Mr. **Lichtblau**. It is one approach that makes sense.

Senator **Bradley**. You also said that in the event of disruption you felt that there would be a public outcry about the amount of revenues that would flow to the oil companies. Is that correct?

Mr. **Lichtblau**. Yes.

Senator **Bradley**. Would you be an advocate for an emergency increase in the windfall profit tax in the event of a disruption?

Mr. **Lichtblau**. Again, I have not gone into detail of what would have to be done, but that may be one possibility.

Senator **Bradley**. You said it was politically unacceptable. What did you mean by that?

Mr. **Lichtblau**. Either you would have to have an instant recycle mechanism or you would have to have price controls or an allocation system.

Senator **Bradley**. Well, the President has decided against price controls and allocations and I supported him on that. So what are we left with? The recycling system?

Mr. **Lichtblau**. Well, if you eliminate the two others you only have the recycling system left. That is correct.

Senator **Bradley**. Thank you very much, I always find your testimony very enlightening.

Mr. **Lichtblau**. Thank you.

Senator **Warner**. I share the distinguished Senator from New Jersey's views.

We will now have Mr. DiBona, who is well known to all of the members of the committee, from the American Petroleum Institute. Mr. DiBona, I have read through both your statements which you have requested be put in the record. That will be done without objection, and I have also looked over your second prepared document, which I presume you will use in your oral presentation. And I would hope that, and I will refresh your recollection, you might have the opportunity to address the five issues, and I have added six, that I enumerated in my opening statement.

Would you proceed?

STATEMENT OF CHARLES J. DiBONA, PRESIDENT, AMERICAN PETROLEUM INSTITUTE, WASHINGTON, D.C.

Mr. DiBona. Thank you, Mr. Chairman. Why don't I simply touch on the very broad points that I make in the written statement and ask that you enter it for the record and then answer your questions.

Senator Warner. The Chair would appreciate that, because I very much want to hear your viewpoints on the issues that concern me and I am sure the others feel the same.

Mr. DiBona. I am Charles DiBona, president of the American Petroleum Institute and we represent some 300 petroleum companies of all sizes and about 800 individual members. From the outset API has strongly supported the strategic petroleum reserve and we regard the SPI as an important Government tool for responding to future energy supply emergencies.

The API supports an emergency crude oil reserve funded, owned, and controlled by the Federal Government. The reserve should be used only if the President formally declares that the country is threatened by a severe energy supply interruption as required by the Energy Policy and Conservation Act.

The President should determine the rate of drawdown and the SPR oil should be made available through competitive auctions, open to all bona fide U.S. refiners. Finally, receipts from any drawdowns should be used to refill the reserve when market conditions allow. That is a synopsis of the position we have taken on the subject and I will be happy to answer any questions.

[The prepared statements of Mr. DiBona follow:]

Oral Statement by
Charles J. DiBona
President, American Petroleum Institute
on behalf of the
AMERICAN PETROLEUM INSTITUTE
before the
SUBCOMMITTEE ON ENERGY AND MINERAL RESOURCES
UNITED STATES SENATE
March 25, 1982

Thank you Mr. Chairman for the opportunity to appear in these important hearings. I am Charles DiBona, president of the American Petroleum Institute, which represents some 300 petroleum companies of all sizes and about 8,000 individual members.

My testimony today is on behalf of the API and its members. I have submitted a longer statement for the record from which these oral remarks are drawn.

From the outset, the API has strongly supported the Strategic Petroleum Reserve. We regard the SPR as an important government tool for responding to future energy supply emergencies.

The API supports an emergency crude oil reserve funded, owned and controlled by the federal government. The reserve should be used only if the President formally declares that the country is threatened by a severe energy supply interruption, as required by the Energy Policy and Conservation Act. The President should determine the rate of drawdown, and the SPR oil should be made available through competitive auctions open to all bona fide U.S. refiners. Receipts from any drawdown should be used to refill the reserve when market conditions allow.

I would like to discuss briefly each of these points in more detail.

Developing the Reserve

Seven years ago, the API endorsed the SPR program in testimony before the Senate Committee on Interior and Insular Affairs. We said that a crude oil storage program would be crucial in maintaining national security if the flow of oil imports were severely disrupted. We also felt that such a program would help protect the nation's economy from the unfavorable effects of a sudden import disruption. And we said that an adequate SPR not only would be useful in responding to a severe interruption but also might, by its very existence, deter countries from imposing or threatening an oil embargo.

The government recently has made considerable progress in filling the reserve. The amount of oil in storage more than doubled in 1981. The reserve now holds almost 250 million barrels of oil. Underground oil storage on that scale is unprecedented in the world.

The Congress has been responsive in providing funds to develop the SPR. API supports direct government funding because the entire nation benefits from the improved national and economic security that the reserve provides. We urge that spending authority for Fiscal 1983 again be adequate to continue developing storage capacity expeditiously and filling available capacity promptly.

As you know, market pricing of oil in the U.S. has helped to reduce oil imports substantially in the past year. The SPR current plan was adopted just after U.S. oil imports peaked in 1977 at nearly 8.8 million barrels per day. In 1981, oil imports averaged 5.7 million barrels per day -- not counting imports for the SPR. Recent import levels have fallen even farther. If imports continue at low levels, the SPR will offer the U.S. even more protection than originally planned.

Energy Emergencies and the SPR

We believe that use of the SPR must be viewed within the context of the government's overall response to an energy emergency.

During future supply interruptions, the consumer will benefit most if the marketplace is relied on as much as possible. The market would provide for the most efficient distribution of available supplies and will minimize the hardship for everyone. Indeed, because people respond to higher prices by cutting demand, market pricing of energy during emergencies can lead ultimately to lower prices than would occur under government controls.

In the past 14 months -- since final decontrol of oil prices -- Americans have seen how well market forces work during normal times. Oil consumption has fallen, exploration has reached record levels; domestic production has begun to increase after a long period of decline; and import levels have dropped significantly. Imports are now accounting for less than one third of U.S. oil consumption, compared with 45 percent in 1979. Competition among sellers has intensified at all stages of the oil business and prices have been falling.

Market forces will work just as effectively during emergencies. If supplies become scarcer, because of a cutback, the market will provide the quickest way to bring supply and demand into balance.

Of course, an approach relying heavily on market forces does not lessen the need to prepare carefully for potential emergencies. Although reliance on markets should be the cornerstone of any approach, we believe certain forms of direct government action, such as use of the SPR, may be needed when supplies are severely cut back.

Appropriate Government use of the SPR

API believes that drawdown of the SPR should begin only after the President declares that a severe energy supply interruption exists, as required under EPCA. The SPR should not be used in non-emergency situations. But it should be used at any time deemed appropriate after an energy supply emergency has been recognized and declared.

The severity of a supply emergency would depend on many variables, including levels of stocks, time of year, weather conditions, estimated length of the interruption and effectiveness of previous measures.

Therefore, the conditions for usage of the SPR should be flexible and adaptable.

The government should assess the need for action as the character and magnitude of a particular problem become clear. A "trigger" mechanism that would automatically initiate SPR drawdown at a specific rate would be inefficient and inappropriate. Such trigger mechanisms would react to forces other than those associated with an energy supply interruption. As a result, they would sometimes signal an emergency when none exists and at other times would fail to signal an emergency in time for effective action.

The API believes that SPR oil should be made available through competitive auctions open to all bona fide domestic refiners. This approach would be easy to administer and would assure that the oil goes to those who are able to convert it most efficiently into products for the domestic market. This approach is consistent with the SPR's goal of alleviating the effects of a supply shortage on U.S. citizens.

Receipts from the sale of SPR oil should be reserved for purchase of oil to refill the reserve. This would assure that funds would be available to rebuild SPR when normal market conditions have returned.

Finally, to avoid drawing down the reserve unnecessarily, any SPR drawdown should be temporary in nature. Procedures should be in place to assure regular review of the conditions which prompted using the SPR, so that the President will halt the usage when conditions have improved sufficiently.

Statement by

Charles J. DiBona
President, American Petroleum Institute

Thank you Mr. Chairman for the opportunity to appear in this important series of hearings. My name is Charles DiBona. I am the President of the American Petroleum Institute, which represents some 300 petroleum companies of all sizes and about 8,000 individual members.

My testimony today is on behalf of the API and its members. From the outset, our organization has strongly supported the Strategic Petroleum Reserve (SPR). We offered our views regarding the legislation that established the SPR and have commented as appropriate regarding the development of the Reserve. The API regards the SPR as an important government tool for responding to future energy supply emergencies.

The API supports a federally owned, funded and controlled Strategic Petroleum Reserve consisting of crude oil. The Reserve should be used only after a declaration by the President of a severe energy supply interruption as required under EPCA. The drawdown rate should be determined by the President and the SPR oil should be made available through competitive auctions open to all bona fide U.S. refiners. Receipts from any drawdown of SPR oil should be used to purchase oil for refilling the Reserve. These points are made in greater detail in the remainder of my statement.

Developing the SPR

The API was an early supporter of a government-owned and controlled SPR. In April 1975 testimony before the Senate Committee on Interior and Insular Affairs we stated:

"A crude oil storage program would be of critical importance to the nation in terms of national security in the event of a future disruption in the flow of oil imports, ... Such a program would also fill a most useful function in helping to protect the nation's economy from the adverse effects of a sudden interruption in the flow of foreign oil to these shores."

The present SPR plan, as revised in 1978, is designed to produce a Reserve of 750 million barrels. The SPR legislation authorizes a Reserve up to one billion barrels.

The recent progress in filling the Reserve should be commended. In calendar year 1981 the oil in storage was more than doubled, with about 122 million barrels added. The average fill rate in 1981 exceeded 300,000 barrels per day.

We might wish that the development of the Reserve had proceeded more rapidly, but it must be remembered that underground storage on the scale already in place -- much less as contemplated in the future -- is unprecedented in the world. The SPR -- approaching 250 million barrels -- now provides a measure of protection from a supply interruption which was not present in 1979 when Iranian oil for export was curtailed. Since a total denial of imports is unlikely, and other market adjustments tend to offset a supply shortfall, an SPR of any given size will provide relief from an interruption in supply for a much longer period than might be inferred simply by comparing it against the level of imports.

The Congress has been responsive in providing the funds necessary to develop the SPR. The API supports direct government funding because the entire nation benefits from the enhanced national and economic security that the Reserve provides. We would urge that the spending authority for fiscal 1983 again be adequate to continue the expeditious development of storage capacity and to provide for the prompt fill of the available capacity.

The present plan is divided into three phases. Phase I is for 250 million barrels of capacity and Phase II is for an additional 290 million barrels. Phase I construction is complete and the capacity nearly filled. Phase II construction is underway and the filling of some of the completed capacity has begun. When completed, Phases I and II will provide a reserve of 540 million barrels. Phase III is for 210 million barrels more of capacity; construction has not yet begun.

As you are well aware, recent free market adjustments in the U.S. have worked to reduce oil imports substantially. For 1981, not counting imports for the SPR, oil imports averaged 5.7 million barrels per day. Recently, import levels have been even lower. If imports were to continue at or near such levels, it would suggest that the SPR could be effective at a somewhat smaller storage size than people had estimated in the past.

Energy Emergencies and the SPR

We believe that use of the SPR must be viewed within the context of an overall government approach to energy emergency response.

During future supply interruptions, the consumer will benefit most if the marketplace is relied on as much as possible. The marketplace offers the most efficient way to distribute supplies during a crisis or during normal circumstances. A supply disruption will cause inconvenience and economic loss to the nation as a whole. There is no avoiding this -- the task is to minimize it. Allowing the market to work to the maximum extent possible will provide for the most efficient distribution of available supplies and will minimize the loss. And because people will respond to higher prices by cutting demand, market pricing can lead ultimately to lower prices than would occur under government controls.

I should emphasize, however, that an approach which puts heavy reliance on market forces does not lessen the need to prepare carefully for potential emergencies. Although we believe that reliance on markets should be the cornerstone of any approach, we also believe that certain forms of direct government action, such as use of the SPR, may be necessary when supplies are severely cut back.

In the past fourteen months, Americans have seen how well market forces work during normal times. Until recently, when U.S. oil imports began to drop dramatically, many people had refused to believe that supply and demand for oil followed the same economic rules as supply and demand for other commodities. Our recent experiences with oil decontrol and higher world prices, however, have demonstrated that consumers and producers in the U. S. do indeed respond to market forces. Oil consumption is falling, exploration to find new sources of supply set a record in 1981, domestic production has begun to increase after a long period of decline and import levels have dropped significantly. Recently, imports have accounted for about 31 percent of U.S. consumption, compared with more than 45 percent in 1979. Product prices have responded to the intense competition brought on by improved supply relative to demand. Prices are lower now than a year ago. In the case of gasoline, for example, the average pump price of leaded regular at the middle of this month was down about 13¢ per gallon from early March, 1981 or nearly 10%, according to Oil and Gas Journal data.

Market forces will work just as effectively during an emergency. If supplies are made scarcer because of a cutback, the market will recognize the change and begin to adjust. Prices would rise at the outset as supplies become less plentiful. These early -- and perhaps short-term -- price rises will encourage more conservation, stimulate higher domestic energy production and encourage more substitution of other forms of energy for oil. This will help to soften the impact of the shortage as quickly and efficiently as possible.

Appropriate Government Use of the SPR

API recognizes that in the event of a severe, prolonged supply interruption, it may be necessary for the government to take direct action on a temporary, limited basis. The SPR will be one of the mechanisms available to the government for responding.

There could be many reasons for an energy supply interruption. An adequate SPR will not only be useful in responding to a severe interruption but also might, by its very existence, deter countries from imposing or threatening an oil embargo.

API believes that the drawdown of the SPR should be initiated only after the President has made a finding of a severe energy supply interruption as required under EPCA. This means that the SPR should not be used in non-emergency situations, but that it should be used at any time deemed appropriate after an energy supply emergency has been recognized and declared.

The impact of an energy supply emergency will depend on variables such as the level of stocks, time of year, weather conditions, estimated length of the interruption and the effectiveness of previous measures.

The rate of SPR drawdown to ameliorate this impact should be set by the President and should depend on an assessment of the severity of a supply shortfall, its possible duration and other compensating adjustments in domestic and world markets.

It is our view that supply disruptions are not likely to follow a predictable pattern. It may be difficult initially to assess the dimensions of a supply shortfall or to estimate its likely duration. As a result, we believe the conditions for usage of the SPR should be flexible and adaptable.

The government, utilizing its own energy emergency response planning capability and other intelligence sources, can carefully assess the extent of any interruption and its probable effect on the national welfare. We stand ready to provide help and insight whenever the government seeks our assistance. An appropriate response by the President, in consultation with the Congress, can then be tailored to the nature of the interruption and its estimated impact on the U.S. This might involve the declaration of an energy emergency, utilization of the SPR and initial setting of a drawdown rate, subject to future modification, if necessary.

A "trigger" mechanism that would automatically initiate SPR drawdown at a specific rate is both inefficient and inappropriate. The various possible trigger mechanisms react to forces other than those associated with an energy supply interruption. As a result they would sometimes signal emergency when none exists and at other times would fail to signal an emergency until it was too late for effective action. API believes it would be better for the government to assess the need for action during each emergency as the character and magnitude of the particular problem becomes clear.

The API believes that SPR oil should be placed into the U.S. distribution chain by the use of competitive auctions open to all bona fide domestic refiners. This approach would be easy to administer and assures that the oil goes to those who are able to convert it most efficiently into products for the domestic market. This approach is consistent with the SPR's purpose which is to alleviate the effects of a supply shortage on U.S. citizens.

We recognize that some people have advocated other, more involved allocation schemes for SPR oil. During the 1970's the government tended to panic at the first signs of a shortage and refused to let the market work. As a result, actions by government made the problem far more severe and long-lasting than it otherwise would have been. Experience under EPAA during supply shortfalls indicates that the federal government does not allocate oil supplies as effectively as does the market. Government, academic and industry studies have consistently found that government price controls and allocation procedures under EPAA worsened rather than improved the distribution of oil during the 1973-1974 and 1979 shortfalls.

When the SPR is drawn down, the receipts from the sale of the oil should be reserved for the purchase of oil to refill the reserve. This policy will ensure that if the nation must use the reserve, then it will have funds available to rebuild it when normal market conditions have returned.

Finally, to avoid interfering with long-term market adjustments or drawing down the reserve unnecessarily, any SPR drawdown during an emergency should be temporary in nature. Procedures should be in place to ensure that the market conditions which prompted the using of the SPR are regularly reviewed so that the President will halt the usage when conditions have improved sufficiently.

Senator WARNER. Let us get right to the heart of things. Your views on this interim storage issue, the types of storage. I presume you have heard of the interim storage concept, have you not?

Mr. DIBONA. Yes, I have heard of that. We have not taken any formal position, Mr, Chairman, on that. The view of the Petroleum Institute is that the storage ought to be the most economical storage that is available and therefore we have always advocated to use the salt domes, because we believe that that is most economical.

We have also advocated that that be used for only crude storage, that there not be product storage because we believe that the system for distribution of the crude to the refineries and the availability of both transportation and refinery capacity is obviously going to be there in these circumstances, because the difficulty is going to be in crude, not in those capacities.

So it is in our opinion the most economical and efficient technical system for operating. With regard to this specific question that is before the committee at the present time, that is given the fact that there are technological problems in evacuating the salt dome in order to put oil in at a faster rate, during this period of time, the possibility therefore of having some alternative kind of storage, we have not taken a position but an extension of our general attitude, which is that you ought to do that if you feel it is necessary to in the most economical way and there are several alternatives.

One is to use ships. We do know that there are plenty of them available. Mr. Lichtblau gave a number that suggested 50 to 100 million barrels capacity. We think that, and the number I will give you is simply the capacity that could be made available, it is 600 million barrels. But that clearly would affect the rates and I think that the distinction between these two answers is that he was giving a number so small that it would be very unlikely to affect the shipping rates. And I am giving you the technological maximum that clearly would affect the rates.

There are about 80 million tons that could be made available in large tankers around the world today.

Senator WARNER. Would you recommend a diversification of that interim storage on tanks?

Mr. DIBONA. I am not arguing you should or should not do it. I am simply saying that if you do do it, the method by which you should decide whether to do it ought to be the cheapest, the most economical way of doing it and you have presently ship wood storage. You have a number of refineries which are presently not operating. That is I would make a distinction between an operating refinery and some that are simply closed down at the present time.

Senator WARNER. Because they have excess capacity.

Mr. DIBONA. Because they have excess, because they have steel tank storage in place and presumably you would only want this for a short period of time. I am not advocating that you should in fact do this, I am simply saying the method by which you should do it is——

Senator WARNER. What about regional diversification?

Mr. DIBONA. We think that for most, if not all, parts of the United States the system of using salt dome storage for crude oil and then using the distribution system that will be in place is the most efficient way of going. Holding it in crude gives you the option of converting it into any product that is necessary at the time and based on the circumstances that exist when we get into a mess.

We clearly will have the refining capacity and transportation facilities available because the shortage would not be in them, it would be in crude. So in our view it is the most efficient and economical and effective method of handling the circumstance would be to continue the system of salt dome storage centrally located and then use of the normal systems for the manufacture and distribution of product.

Senator WARNER. You are not that strong on regional diversification?

Mr. DIBONA. No, sir.

Senator WARNER. Any thoughts on private versus public SPR?

Mr. DIBONA. We clearly support public financing and ownership and decisions about distribution.

Senator WARNER. What about the product contained in reserves versus the product?

Mr. DIBONA. For the same reasons that would cause me to support the salt dome storage we do not support product storage. It is more efficient to have it in salt domes and use salt as a facility.

Senator WARNER. Last, do you have any comments on the impact of the veto on this situation?

Mr. DIBONA. We have in the petroleum industry supported the notion of letting the market do as much as it possibly can. We have found, and I think can clearly demonstrate, that in two crises, the two major crises we have had the Government involvement made it worse not better, that there was no need for people to have been in gasoline lines in 1973 or 1979, had the market been permitted to operate.

And furthermore, the OPEC prices could not have gotten to the levels they in fact got, had we not acted to limit, to encourage imports into this country and discourage conservation and that was a direct result of Government policy. So we do strongly hold the view that we should use the market as much as possible.

Now, this particular bill did have other provisions in it, some of which we thought were important. The API members, incidentally, were quite split on whether or not they should be supportive or not.

Senator WARNER. Just to make it clear for the record, you told me that privately, and therefore we have not pressed your position on that.

Mr. DIBONA. That is right. There is one provision of that act that I think the great majority of API members did support and that was the provisions dealing with the preemption of State laws in this area. Because what we all fear is that there would be an explosion of individual State regulations done under tremendous pressures in a shortage circumstance, which could just absolutely be chaotic, where no individual company could possibly respond to them and they would be totally counterproductive.

And this law did have provisions to preempt that kind of activity and we hope that part of it certainly can be revisited.

Senator WARNER. Another important thing, I think, is the extension of the IEA antitrust immunity. What are your thoughts on that?

Mr. DIBONA. Well, obviously there is a special problem with IEA, but in an emergency quite apart from the IEA, the petroleum industry would like to be of as much help to the U.S. Government in dealing with the problem as possible and we will do everything that we can.

However, our ability to give advice is very much limited today by the antitrust rules and was very limited in the last two crises, where I personally was involved in meetings where almost nothing could be said and it was very frustrating to the Government and very frustrating to people who wanted to help and there really needs to be some mechanism set up whereby the Government can get advice from people who are most familiar with the technical aspects of distribution of fuel and that is very, very difficult to do today without some kind of special treatment under very special safeguards, but some special treatment of this problem.

Senator WARNER. Senator Bradley.

Senator BRADLEY. Thank you, Mr. Chairman. You support the idea that you want to fill the strategic petroleum reserve?

Mr. DIBONA. I certainly do.

Senator BRADLEY. Do you think that as you look at the uncertainty of the Persian Gulf that it is in our national interest to do that?

Mr. DIBONA. There is no question about it and from a number of points of view one of them just the simple economics of it.

Senator BRADLEY. Do you find that we should, particularly in a slack market, fill, buy every barrel of oil we can get?

Mr. DIBONA. Yes. Although I must say, that obviously you want to buy it at the lowest possible price to fill the reserve. That is in the Nation's interest.

Senator BRADLEY. But as a person that represents business people you were advising the Government that it is now contracting for oil that is available on the market at $5 less that it would make rather commonsense to buy the oil on the spot market at less than the contract price; right?

Mr. DIBONA. Well, I guess I have to say to you that I do not know what the future price of oil is going to be, so I don't know if it is advantageous to buy it later. It is almost cheaper than it was 6 months from now.

Senator BRADLEY. The point is the Government is not buying the oil. We contracted last year for oil that is on the market today for $5 less than it was contracted.

Mr. DIBONA. I do not know what the details of the contract are.

Senator BRADLEY. Take my word for it; it is a better deal.

Mr. DIBONA. I don't know if they contracted to buy the oil and the then going price was at a fixed price. I don't know.

Senator BRADLEY. The idea of filling the reserve would come into a unanimous agreement on the dispute over what the rates should be. Say there is an interruption and you want to get the oil out of reserve, would you think that an auction would be preferable over an allocation system?

Mr. DiBona. Absolutely. There is no question in our mind that would be a much more efficient way to do it and get the fuel where it is most needed.

Senator Bradley. S. 1503 was supported in large part by Members of the Senate in that we have to protect the farmers in the planting season or the older citizen in the winter. Can you explain for the record how the market would accomplish these ends?

Mr. DiBona. You see the history shows that there was never a shortage anywhere until the U.S. Government got involved with price and allocation controls. They created the shortage and then the same people who advocated those programs then felt that they absolutely needed a further demonstration in trying to solve the problem with the same mechanism that in fact created the problem.

So the simple answer to that is the markets; it has demonstrably worked. For the first time this past year we have had the relief from controls and for the first time the price is falling instead of rising both in real and nominal terms. There are tremendous supplies available. People are conserving. The price is now lower than it was a year ago, absolute demonstration that we ought to be willing to do that and it will work in most emergencies.

Senator Bradley. So you are saying the farmer will get his oil.

Mr. DiBona. There is absolutely no question in my mind.

Senator Bradley. Why is there such a resistance in Congress to that idea? I have advocated that position.

Mr. DiBona. I know you have.

Senator Bradley. Tell me why.

Mr. DiBona. I think it is a fear that has been engendered by the history of the last few years. I mean not everybody understands as you do that it was caused by the allocation and price control system. There were people telling them that they were going to be protected from these problems by the controls. They did not understand that it was the controls that were causing it.

So one of the problems was an educational problem for people. There was a period when the farmers were provided with tremendous volumes of fuel when there were shortages in other places, I mean particularly distillate in, I think it was, the spring of 1979 and they do remember that. They do remember everybody else being short and them having a lot of fuel and that was in fact correct, because people were very worried about getting the crops in and provision was made.

Senator Bradley. So the farmers got it but the commuters did not.

Mr. DiBona. That is right and a lot of other people did not.

Senator Bradley. What do you say, yesterday on the floor Chairman McClure in response to my comments made the point that diesel fuel was not under controls in the 1979 disruption and yet there was a diesel shortage. What is your response to that?

Mr. DiBona. Well, the crude oil was under control and it is not true that there were no controls. In fact, there were rather elaborate controls. They were still controlling refinery operations and there were distribution controls on and there was a very explicit part of the program which was monitoring what was happening in diesel, in fact the whole distillate line, to make sure that it did not stray very far from what controls would have cost.

Senator **Bradley**. So you are saying that unless you can have a free market environment for the whole thing you cannot decontrol.

Mr. **DiBona**. It is a highly integrated market. You cannot decontrol. If you are controlling gasoline, you are controlling diesel oil.

Senator **Bradley**. I think that is a good record for the efficiency of the market. Say there is a disruption, we know one thing, the oil price is going to go up in a disruption not down. If it does go up some people will be hurt by this because they will not have money to pay.

You also know that your members are going to be paying more windfall profit tax. That is the law. Do you see any reason that—what we might do in this environment is consider the recycling mechanism to give those individuals the means to pay the higher oil prices while letting the market work.

Mr. **DiBona**. Let me say that we have always advocated, and in fact I sent a letter to every Member of Congress, dealing with the basic problem of the impact of increased prices on the poor in the United States. We are very sympathetic to that problem. We have never recommended a particular mechanism for doing that because we don't think we are experts on the welfare system.

Senator **Bradley**. But you are saying deal with the equity problem directly?

Mr. **DiBona**. That is correct. Now you are going to get a tremendous recycling automatically as a consequence of that, at least a tremendous inflow into the general fund of the United States, as a consequence of the existence of these windfall taxes.

Senator **Bradley**. That is my point.

Mr. **DiBona**. Because when you eliminate the control system that existed at the time the impact will be on crude prices not on downstream and therefore the recaps will be enormous.

Senator **Bradley**. One last question. Are you in favor of an oil import fee?

Mr. **DiBona**. The API at the present time is researching that question and we have not yet come to a final conclusion on it. There are a number of members of the API who oppose it because they believe it has several bad effects, one of which, for example, is the impact upon energy intensive exporting firms.

That is, such a fee will make them less competitive on world markets. So there are a number of other impacts from that.

Senator **Bradley**. Your caution is really not of economics or cost. Your caution is whether the import fee would raise the price and therefore depress the market and various purchasers of the oil.

Mr. **DiBona**. No, that is not my point. I mean I think that this has a number of, there are a number of impacts of an import fee. One of them is that.

Senator **Bradley**. Right. But what is your point?

Mr. **DiBona**. One of the problems is that it could, U.S. firms that are large users of, for example, petro chemical firms that are large users of petroleum as a raw material, yet are very active on world markets, could be very adversely affected by it and therefore that could have a negative effect on U.S. competitiveness in a way which is quite inefficient.

Senator BRADLEY. Because they would have to pay the import fee?

Mr. DIBONA. Because the price of all crude in the United States would rise as a consequence of the import fee. So there are clearly people who have objections to it of that kind. There are other people in the petroleum industry, producers, who like the idea of the import fee and we are trying to come to some kind of conclusion at the present time.

Senator BRADLEY. Do you think you will come to it by May 15 when we will vote on it?

Mr. DIBONA. Yes. I hope that that will be the case. We are not a monolithic industry, you know.

Senator BRADLEY. Thank you. I have discovered that.

Senator MATSUNAGA. Mr. DiBona, I see that you have been to Heaven and back. You have spent some time in Hawaii.

Mr. DIBONA. Yes, sir. I was on the big island and I have been to the other islands on a number of occasions. I was in the Navy, as a matter of fact.

Senator MATSUNAGA. Well, at least you have the satisfaction of knowing what Heaven looks like if you happen to go the other way.

Of course, SPR is very important and the theory is that we may need it because we are unable as we operate now to produce what we will be needing. In the 8½ years since the 1973 energy crisis, the price of oil has gone up tenfold, as you know.

Mr. DIBONA. Yes.

Senator MATSUNAGA. And it should have been an incentive for greater production. We were told that when we decontrolled the price of oil domestic production would go up. But from my studies, I find that we are today producing less oil than we did in 1973. Suppose there is an immediate cut off of oil because of the situation in the Middle East, which could happen at any time. Suppose there is a cut off in imports today causing the price of oil to jump to $50 per barrel. Would you expect our domestic oil industry to produce more than we are producing today and in sufficient amount to take care of our emergency needs, say, within the next 5 years?

Mr. DIBONA. Well, let me just back up and explain the record of oil production and price. Oil prices immediately after World War II rose quite sharply and it set off a drilling boom in the United States and in 1956 the peak drilling activity occurred at 57,000 wells being drilled.

The reserves rose quile sharply as a consequence of that activity. From about that time, in fact from 1954, the prices had stabilized and started to decline and the prices were in a long-term decline from then until the early 1970's. During that period of time, the drilling followed the price decline for oil and we fell to about 27,000 wells in the very early 1970's, about 1970 or 1971.

Senator MATSUNAGA. Reduced you think?

Mr. DIBONA. The number of wells being drilled per year fell from an all-time high of 57,000 wells to 56,000 down to about 27,000 wells by about a half in 1970–71, just about the beginning of the decade of the seventies. As the prices rose in this period, the drilling activity started to increase.

In the early seventies we were using up reserves that had been developed 10 years or more before in more prolific fields. With the exception of the Alaskan blip, there was a secular decline that was due to the simple exhaustion of those fields and we were declining for almost all of the seventies at about 300,000 barrels per day each year.

That is each year this old resource was being depleted and it was no longer able to produce at the rate in which it had formerly produced and we were every 3 years producing about a million barrels a day less. Since decontrol was started, that is by Mr. Carter in 1979, there was an upsurge, a much sharper upsurge in the amount of drilling activity and this decline started to slow down.

When Mr. Reagan completed that decontrol there was another burst in activity. So that we went from having a round 2,000 rigs operating in the United States to 4,600 rigs operating and we drilled last year almost 80,000 wells. It was not only more than the historic record, it was a very large amount more than the historic record and we were drilling over three times as many wells as we had drilled in the early seventies.

Last year we found more oil than we produced for the first time in a decade and this year for the first time in a decade we are producing more oil than we produced a year ago that we stopped the decline and we are on an upward swing. The prices are softening now due to decontrol. The world price is softening.

There is the windfall tax that is depleting the amount of money available and we are not using as many rigs right now as we did a few months ago. We are still operating 4,000 rigs, it is a little over that about 600 down from the peak. I don't know what is going to happen in the future.

To answer your question if the price of oil, I think you said went to $50 a barrel, you would see another boom and we would go over 4,600 rigs and we would produce a little more oil. We will not produce a lot more oil. It will take a tremendous effort to slow, it has taken a tremendous effort to slow this decline of 300,000 barrels per day.

Senator MATSUNAGA. Not enough to replace the imports from other nations.

Mr. DIBONA. That is correct.

Senator MATSUNAGA. In the period even within the next 5 years?

Mr. DIBONA. No, that would not happen. Although you understand there are a number of things occurring. One of them is the substitution of coal for oil on a larger and larger scale and a number of other activities of that kind, tremendous conservation. One of the incredible things about decontrol is the amount of oil we are saving.

We are using much less gasoline today than we were when people were in gasoline lines in 1979. Despite the very, very cold weather this year, we are using 6 percent less fuel oil than we did a year ago, despite the fact that the price is now lower than it was a year ago.

A lot of forces have been set off in this country as a consequence of decontrol. It has been absolutely the most clearly successful experiment that we have had in the energy business in the last 10 years and it has added dramatic improvements in our situation.

We are importing as a consequence a little over 5 million instead of over 8 million barrels a day. And last week we imported 3.7, I think.

Senator MATSUNAGA. Thank you.

Senator WARNER. Thank you very much, Mr. DiBona. Your insight is very valuable to this committee.

We will now hear from Mr. Alvin Alm. Mr. Alm, I have read through your statement. I will ask to continue the hearing until you have an adequate opportunity to present your viewpoints and to respond to questions from the members. I have studied your book and its contributions with great interest in the context of my work and I wish to compliment you.

STATEMENT OF ALVIN L. ALM, DIRECTOR, JOHN F. KENNEDY SCHOOL OF GOVERNMENT, HARVARD UNIVERSITY, CAMBRIDGE, MASS.

Mr. ALM. Thank you, Mr. Chairman. Perhaps I can save time by just reading my very short statement, which is only a little over two pages. I would like to address two issues in this testimony, one, how we can fill up our strategic reserve during this period of soft world oil prices and, two, what can be done to manage drawdowns on the reserve?

I have attached a paper prepared by a colleague and myself on building buffer stocks in a bear market. In that paper, Mr. Krapels and I conclude that the private stocks are on their way down because of high interest rates, that the reserve fill rate will be slowed because of capacity limits and accordingly that options should be considered to speed the building of strategic stocks.

In that paper, we conclude that incentives to the private sector to hold additional stockpiles are not promising. After steps are taken to prevent windfalls during a period of rapid price increases, an incentive proposal becomes as complicated as a regulatory proposal.

A base must be established to prevent credits being available for the 1.3 billion barrels of stocks that are normally held for operational purposes. Some additional system is probably politically necessary to assure that profits from an upward shift in the value of the inventory are shared with the Government.

We conclude that one way to prevent erosion of total U.S. reserves would be for the Government to lease oil storage facilities of even stored oil itself. A number of potential storage sites have been identified by the Department of Energy and others that might be utilized under such a program.

Leasing oil with an option to buy would provide insurance without the large upfront cost of buying the oil to begin with. To get such a program underway, the Department of Energy could solicit bids to determine what program costs might be involved.

The world oil market is likely to be slack for the next few years, providing an excellent time to build up our reserves. But unless we find a way to augment capacity beyond that now planned, we will not have taken full advantage of this opportunity.

I would now like to turn briefly to the SPR drawdown management. It strikes me a number of considerations are important in developing a drawdown strategy; allowing graduated responses to a crisis; providing some predictability in world oil markets; keeping options open in case events become catastrophic.

The Government is likely to act like a private company at the onset of an interruption, namely it will, if anything, want to build up stocks. Yet we learned in 1979 that a small oil supply interruption can cause a 120-percent price increase in only 1 year. Indeed, in general, strategic stockpiles are not used during interruptions.

One way to overcome decisionmakers' reluctance to make SPR decisions would be through creating a futures market. Rather than discharging oil itself during the early stages of an interruption, the Government, either directly or through established financial markets, could sell futures contracts or options to purchase SPR oil.

If it did so the Government would not need to make a finding that the oil interruption was serious, since the futures contracts or options would only result in oil being released if market conditions were indeed in turmoil, If the interruption were not serious the oil would never leave the reserves.

The futures market could have substantial benefits in calming market behavior. Industrial firms and companies will know that supplies will be available in the future. Rather than bidding up spot market prices during the early stages of an oil supply interruption, oil companies can hedge by buying futures contracts, that is contracts to take delivery of oil at some time in the future. By hedging against the future, oil companies can comfortably draw down their oil stocks, their own stocks.

We have additional work to do on this subject and hard work before we can conclude it is the best approach. But to date the results have been promising.

These two issues are terribly important, filling the strategic petroleum reserve and deciding how to use it. They also tend to be boring. Perhaps one of the toughest challenges posed by the threat of oil interruptions is to sustain interest in seemingly boring implementation problems during an oil glut.

Thank you very much.

[The paper submitted by Mr. Alm follows:]

BUILDING BUFFER STOCKS IN A BEAR MARKET: POLICY CHOICES FOR EMERGENCY OIL RESERVES*

(By Alvin L. Alm and Edward N. Krapels)

Building a strategic petroleum reserve has proceeded during the past two administrations in spite of controversy over emergency measures in general. While free market advocates claim that the market can handle supply interruptions if it is merely left alone, interventionists counter that the market is unlikely to work correctly without the use of price and allocation controls. These disagreements have forced a stalemate over most elements of energy security policy. Yet, the two sides generally share the same, strong commitment to developing a large strategic oil reserve. Such an underlying consensus testifies to both the intellectual credibility of the reserve concept and its political acceptability to decisionmakers.

The Strategic Petroleum Reserve (SPR) is designed to serve a number of purposes. As a major new supply source, it should reduce concern over availability and price during an oil emergency, thus reducing much of the panic stockpiling that drives up prices. Depending on the depth and duration of an interruption, strategic reserves could substantially reduce prospective world oil price increases and subsequent macroeconomic damage to the world economy. The Congressional Budget Office estimates that for a 3.5 mmbd interruption, each barrel of oil released from a strategic reserve would reduce real GNP losses by $216 to $374 during the year of the shortfall.[1] In addition, a large reserve could enhance political options by buying time during periods of international tension and by providing a basis for cooperation among the alliance powers. Large stockpiles might even deter certain

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* The authors gratefully acknowledge Michael Pontrelli for his assistance throughout the writing of this paper.

forms of politically inspired embargoes. Finally, if an interruption were severe, the SPR would reduce personal inconvenience and actual hardship resulting from insufficient supplies.

Despite such benefits, as well as strong, nonpartisan support, the future of U.S. emergency reserves is in doubt. The impressive progress made in 1981 is not likely to be repeated. During this period, the SPR increased from slightly over 100 million barrels to roughly 220 million barrels by the end of the calendar year; it was filled at an average rate of 330 thousand barrels per day.[2] Private stocks dropped somewhat from 1980 highs, but remained above historical levels. If this rate of progress were sustained, which is sensible considering the present oversupply of oil, we could be optimistic about the future of our strategic reserves. Unfortunately, current plans call for a drop in the SPR fill rate, while private stocks are likely to fall as well.

Barring a change in approach, the drop in fill rate will occur automatically because of reserve capacity limitations. At the end of October 1981, the capacity of reserve salt domes was 250 million barrels. One year later, available space will have grown to only 267 million barrels due to physical constraints on the rate at which new capacity can be brought on line (see Table 1). Not until fiscal year 1986 does the strategic reserve pass the 500 million barrel mark, which is only half of its original target and which occurs six years later than proposed by President Carter. Assuming the need for at least 90 days of imports, or about 500 million barrels, the United States will face a "window of vulnerability" until mid-1986 under the current SPR program.

Table 1

DOE Expansion Goals and Fill Based on July 1981 Expansion Schedule

Fiscal Year	Storage Capacity Available at end of fiscal year (millions of barrels)	Annual daily oil fill rate during fiscal year
1982	267	186,000†
1983	343	208,000
1984	417	203,000
1985	456	107,000
1986	538	225,000
1987	611	200,000
1988	670	162,000
1989	750	219,000
Average		189,000

† GAO calculation based on DOE's goal of filling 267 million barrels of available storage capacity by the end of fiscal year 1982.

Source: SPR Acceleration Report to the Secretary, July 1981, Strategic Planning and Analysis Division, SPR Office.

Figure 1 summarizes the problem in graphic form. The current SPR target of 750 million barrels, or about 120 days of import protection, will be achieved in 1989. Because of physical constraints, the reserve would be limited to a fill rate averaging less that 200,000 barrels per day, compared to the 330,000 barrels per day during calendar year 1981. In contrast, a "fast-track" rate of 300,000 b/d would effectively achieve the 750 million barrel level by 1987, while closing the window of vulnerability by 1985. Such an accelerated track would require the adoption of one or more of the initiatives that will be discussed later.

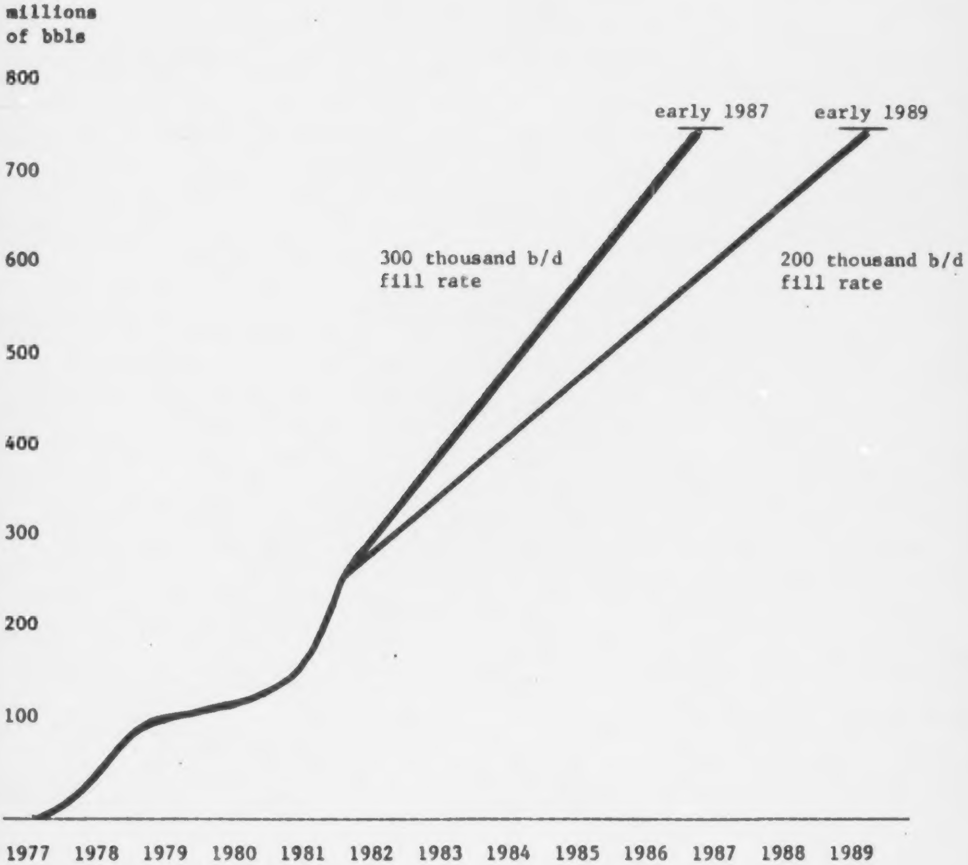
The threat of diminished funding poses a second problem. Looming federal deficits make the multi-billion dollar SPR program an attractive target for the budget axe. The fiscal year 1983 budget for the Department of Energy currently provides sufficient funding to fill at the physically constrained rate of 200,000 barrels per day. But SPR budget cuts will remain an inviting way to reduce government borrowing requirements in the future.

The decrease in the rate of SPR fill is particularly troublesome because private stocks are likely to decline in the near future. Figure 2, which traces crude oil stocks during the 1970s, shows that companies held between 19 and 24 days of stocks (defined as refinery input) throughout the 1972-79 period. After the Iranian Revolution, however, inventories soared to a range of 26 to 34 days. These stocks were built up during 1979 and 1980 because of fear of shortages and higher prices. Today, conditions are different. World oil prices are falling, interest costs are high, and the world oil market appears stable. With interest rates of at least 15 percent, the cost of holding a barrel of oil for one year is in the range of $6 to $9. Oil prices would have to rise sharply to make private stockpile investments pay off.

Figure 1

SPR DEVELOPMENT AND PROJECTED GROWTH AT:

200 and 300 thousand barrels a day 1977-1989



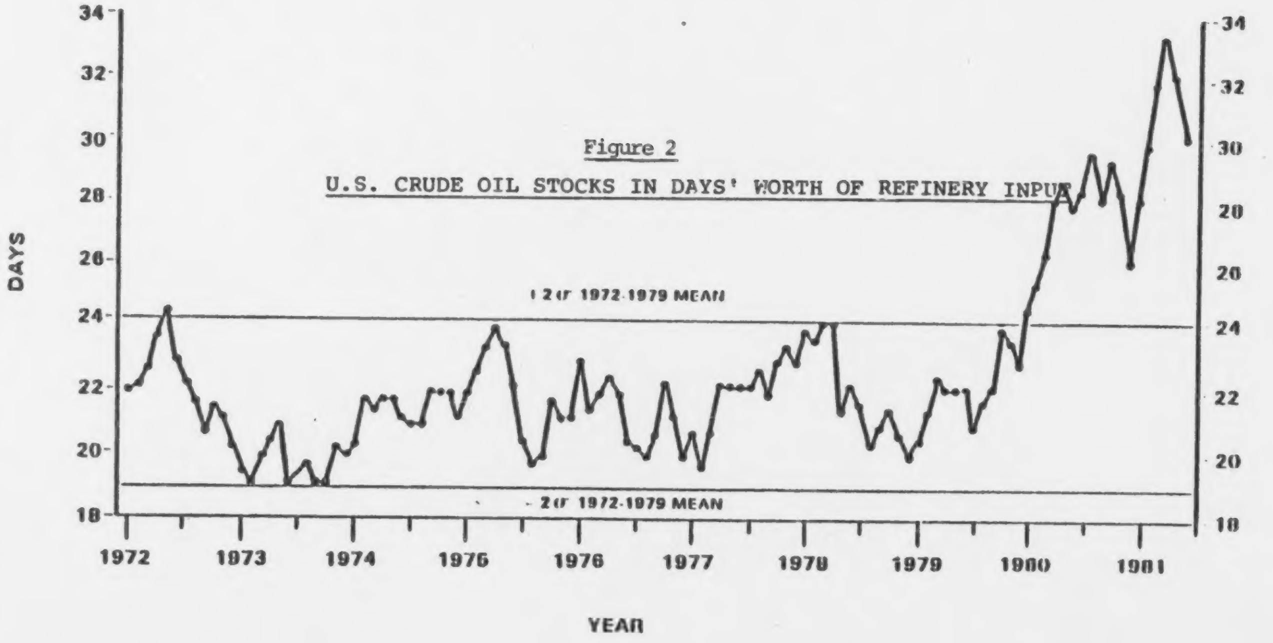


Figure 2

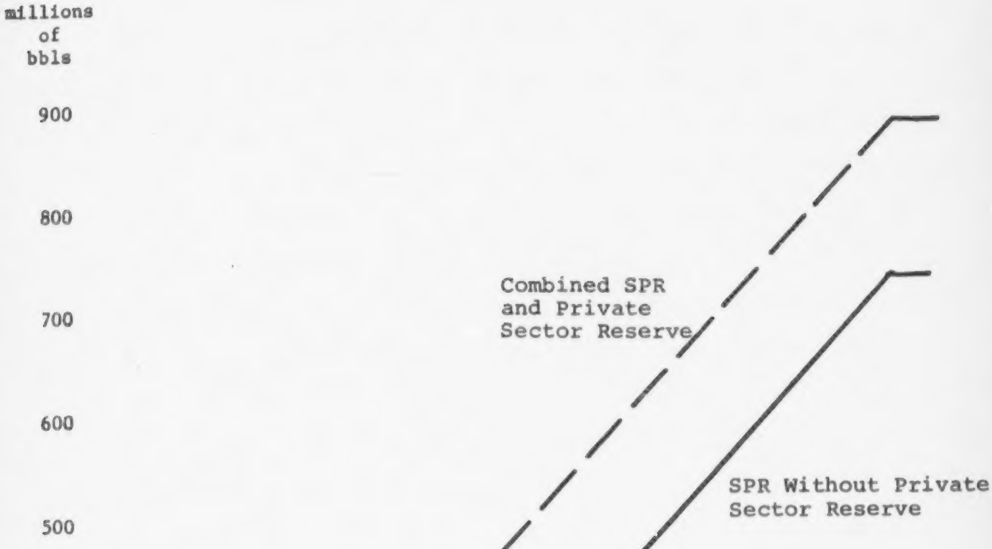
U.S. CRUDE OIL STOCKS IN DAYS' WORTH OF REFINERY INPUT

The major oil companies claim they are in the process of liquidating inventories. DOE data indicate that stock levels remained relatively constant through the close of 1981.[3] However, these same data show that oil company liftings are declining, though such reductions have yet to overtake drops in demand.[4] On the whole, industry claims are supported by this evidence, while continued high stock levels may be due to greater than anticipated consumer demand reductions and to the fact that oil companies are often constrained by established contracts with oil-producing nations. Whether stocks will eventually fall as low as historical levels is uncertain, since oil companies may elect to hold somewhat greater insurance stocks. However, the obvious costs of holding stocks, coupled with current expectations about world oil prices, will most likely lead to a rapid drawdown of stocks during 1982.

Private stocks greatly enhanced total U.S buffer stocks in 1980 and 1981, and could continue to do so until the SPR is larger. Figure 3 shows in simplified form how private sector stocks could add to our import interruption insurance. The lower curve shows the excess of private inventories over estimated normal operating levels. The two upper curves show the expansion of emergency reserves due to a private sector stockpile equivalent to ten days of oil consumption, or twenty-five days of imports (assuming the planned SPR fill rate of roughly 200,000 b/d). The 150 million barrel reserve represents a 50 percent addition to total U.S. emergency stocks by 1983, which shows how useful private stocks could be during these early years. By 1989, however, private stocks would represent only 20 percent of the total, as the SPR assumes an increasingly large percentage of the total.

Figure 3

DEVELOPMENT OF U.S. RESERVES UNDER DIFFERENT ASSUMPTIONS ABOUT PRIVATE SECTOR INVENTORIES



Much of the public concern over reserves has focused only on size. Yet, there are also real questions as to whether management of the reserve will produce the intended benefits. If strategic stockpiles of other commodities are any indication, the SPR may not be used at all, except in a dire emergency. And whenever the reserve is used, simply distributing large amounts of oil in a short time will be an enormous logistical task with considerable room for breakdown and confusion. In addition, strategic reserve drawdowns will be subject to intense political pressures. During an interruption, data will be confusing and contradictory, recommendations will be diffuse, and decisionmakers, exercising bureaucratic caution, will wish to keep options open as long as possible.

These barriers are of particular concern given the need to act quickly and decisively at the outset of a supply interruption. In 1979, for example, the primary cause of economic damage was not the interruption itself, but panic buying induced by the shortfall. When oil companies perceived that future supplies would be tight and prices higher, they rapidly built up stocks, which led to the 120 percent price increase in 1979. In theory, the government could quell panic and blunt initial price pressures through effective use of the strategic reserve. In practice, for both the administrative and political reasons outlined above, such effectiveness may not be forthcoming. Hence, a combination of public and private stocks may well be of greater value than an equal amount of public reserves alone.

These four concerns -- a physically constrained SPR fill rate, threatened budget cuts, declining private stocks, and management limitations of a centralized reserve -- all argue for reexamining U.S. stockpile options. Indeed, considering the current political consensus, stockpiles may be the only available means of combatting supply interruptions. It is helpful to formulate the various policy options according to these categories:

- Options aimed at speeding up SPR fill by overcoming physical constraints.
- Options aimed at overcoming physical and budget constraints.
- Options aimed at creating permanent private stocks.
- Options aimed at establishing a mechanism to involve oil companies in stockpiling decisions.

Each successive set of options adds new objectives to the preceding set. For example, the first set of options would simply provide for alternative storage capacity faster than the current SPR plan. The second set would not only require extra capacity, but alternative financing for oil purchases as well. The third would meet the first two objectives, while also establishing a permanent strategic level of private stocks. And the final category would demand an entirely new institutional and financing arrangement for the storage of oil, in addition to meeting the other objectives.

Options Aimed at Speeding up SPR Fill by Overcoming Physical Constraints

1. Government ownership. The most straightforward option, and one listed in the Department of Energy's Acceleration Report to the Secretary,[5] would be to purchase and fill steel storage tanks in addition to filling the salt domes. Presumably, the tanks could be close to existing SPR sites and pipelines, allowing the Department to integrate their use with the rest of the strategic reserve. The extra oil could be transferred to the salt domes as further capacity is developed or it could be permanently stored in the steel tanks as a net addition to the SPR.

The direct purchase of steel tanks has a number of advantages. It would not conflict with the current management system for the SPR. It does not, for example, raise questions about who owns the reserve, or how it would be sold. The oil could be withdrawn and distributed along with oil currently in the salt domes; no special transportation or transactions would be necessary.

The disadvantage is cost. New steel tanks cost anywhere from $8 to $12 per barrel of storage, compared to the reserve's salt dome costs of $5 per barrel.[6] For temporary storage, leasing of space may be a cheaper option, as discussed next, but the purchase of steel tanks may be desirable if a long period of storage is forecast before transfer to salt domes, or if the oil is to be permanently stored in tanks.

2. Leasing space. The government could lease private storage space for the reserve, presumably at already existing facilities. At least one U.S. chemical company reportedly has excess salt cavern space available. For years, facilities have been offered for lease in Rotterdam. Oil tankers could also be used during the current glut. Indeed, some tankers are slated for the scrap heap unless an effective use can be found for them. As U.S. oil companies draw down stocks, some of their capacity may become available at reasonable cost.

To initiate a storage leasing program, the government would request bids to store SPR oil for specified periods of time. Assuming that some of the resulting bids were attractive, the government could choose how much oil to store in leased facilities based on these firm cost estimates. It would then lease the facilities, purchase the oil and store it for the specified time period. As further salt dome capacity is completed, the oil could either be physically moved to the salt caverns or, more likely, traded for equivalent amounts of oil in transit to the United States.

This option is a potentially cheap way to reduce the window of vulnerability. It does, however, add a layer of management complexity. If the oil is stored on the site of a particular refinery, how readily available is it for sale and distribution to other refineries? Would some arrangement need to be made for swaps of oil to overcome logistical problems? While troublesome, the oil industry has dealt with the logistical transfer of oil for some time. Presumably, such transfers could be arranged as part of a leasing arrangement as well.

Options Aimed at Overcoming Physical and Potential Budget Constraints

A number of options are available to overcome both the physical constraints on the current SPR program and the potential constraints of tighter budgets. These include direct government leasing of stockpiled oil or providing incentives for industry to stockpile. Both options imply substantial changes in the current system of managing the strategic reserve.

3. Government Competitive Leasing of Oil Storage. The government could lease oil as well as storage space from the private sector. For example, it could choose to lease 150 million barrels from industry through 1985, with the option to purchase some or all of that oil in subsequent years. Such an option would be exercised either during an interruption, or when the lease was about to expire as a means of filling the salt domes. As with the previous leasing option, the program would be initiated through government solicitation of bids. Once bids had been evaluated, the government could choose the most appropriate mix of oil storage. While cost would be most important,

proximity to pipelines and refineries would also be a consideration in selecting among the bidders. A 150 million barrel leased reserve would cost $900 million to $1.35 billion annually in carrying and storage costs.[7] This compares with a $700 million cost to hold a similar amount of oil in the strategic reserve. What this option avoids, of course, is the large initial outlay -- on the order of $5 billion -- required to buy the oil.

Two features would be necessary to make a leasing program acceptable. First, the leased oil, even if stored at refineries, would need to be rigorously segregated for management purposes, as well as to demonstrate that the oil is not to be regarded as part of companies' normal operating stocks. Second, the government must be able to purchase the oil during the leased period at some specified price. During supply interruptions, the oil would then be resold at auction, with all firms having an equal chance to bid.

This proposal has the attraction of providing insurance quickly without large, near-term budget costs. It should also be popular in the private sector, particularly with oil companies. If successful, it could tap low-cost storage options and allow the government to stockpile aggressively by leasing as well as purchasing oil while prices are low.

It does have drawbacks. Although an effective way to overcome both physical and budgetary constraints, this proposal is more costly than direct oil purchases in the sense that the government's cost of capital is less than industry's. Second, during an interruption, this proposal would require huge outlays to pay for the leased oil. If the full 150 million barrels were purchased, the cost would be $5.25 billion at current prices. Revenues from resale of the oil should more than cover these costs, but the large emergency appropriation may be difficult to steer through Congress.

4. Traditional tax credits for industry storage. Structuring a tax credit for private stockpiles is not as easy as it seems. Difficult conceptual problems arise as to the level of the credit, the private stocks to which it would apply, and the distribution of gains from ultimate sales. This analysis covers only some of the issues that would need to be addressed. It does confirm that any economic incentive is likely to be complex in practice.

One must first determine the proper level of the subsidy. Let us assume that oil costs $33 a barrel to acquire and that any new storage capacity would cost $10 a barrel to construct. Let us further assume that interest costs on corporate bonds are 15 percent, (12 percent on long-term government bonds), and that a firm's before-tax opportunity cost is 30 percent. On this basis, should the government subsidize both storage and the carrying cost of the oil? Should the rate of subsidy be based on the firm's financial opportunity cost, the firm's borrowing cost, or the government's borrowing cost? Or is some other level appropriate?

Some of these questions can be answered, at least tentatively. There appears to be no need to subsidize storage. Either a firm will have available capacity now, or it could take advantage of a one-year write-off for new capacity, which is basically equivalent to a 50 percent subsidy. (Some payment may be necessary if operating costs are significant, probably on the order of $1-$2 a barrel). There is probably no need to subsidize at the firm's opportunity cost of capital either, since stocks have operational and insurance value. The firm's or the government's cost of borrowing are both possibilities, although neither has any definitive conceptual base. The difference between these options is large: roughly $10 a barrel at the firm's opportunity cost, $5 a barrel at the company's cost of debt, and $4 a barrel at the government's borrowing cost. Since we have no good measure of the marginal benefits and costs to oil companies of holding additional stocks, we can only speculate about the proper subsidy level.

An even more perplexing problem is how to establish the category of stocks for which subsidies would be paid. Since two-thirds of all stocks are held for minimum operating purposes,[8] an incentive program should be designed to cover, at most, only stocks above this level that could readily be drawn down during oil cut-offs. If one assumes that industry will choose to return to the 19 to 24 days of stocks that were held during the 1973-79 period, then the subsidy need only cover reserves in excess of these levels. Each firm's base period could be established from some average over the period and only stocks held above that level would be eligible for tax credits. On the other hand, if one assumes that the higher stock levels held since the Iranian Revolution represent a new consensus on the risk of an interruption, then 1980-81 stock levels may well be appropriate as a base. A third option would be some average between the two periods.

Deciding on an appropriate base level will be critical to the success of the program. If the base is set too high, the tax credit will not cost much but it also will not accomplish much. If the base is established too low, then treasury losses could be substantial in proportion to gains in stock levels.

If oil prices again rise sharply, the distribution of economic benefits from stockpile sales also becomes a serious issue. If the oil companies are allowed to collect all the economic rents, then taxpayers would be footing the bill for the companies' speculation. If the government captures the gains, then the incentive to oil companies to participate is decreased and the subsidy must be increased. In practical terms, the increased rents should probably be shared. But to do so, the stockpiled oil would have to be accounted for from purchase to final sale.

Overall, an industrial tax credit for stockpiling is extremely complex, as the discussion of credit size, eligible stocks, and division of profits clearly shows. The marginal tax rate for many companies may already be so low that the tax credit would not act as an incentive. If building greater private stocks becomes a major public policy goal, then different formulations should be pursued.

5. Price Guarantees for Private Stocks. Private firms currently have little incentive to maintain stocks above normal operating levels. Oil prices must increase by at least 15 to 20 percent a year simply to cover interest costs on these extra stocks. While this was the case in both 1979 and 1980, today's declining prices and high interest rates have combined to make surplus stockholding generally unprofitable. Barring another supply interruption, such price increases appear unlikely over the next few years as well.

One means of encouraging higher stocks would be to provide greater assurance about the future. Specifically, the government could enter into contracts to guarantee the future price of oil, and to pay firms the capital cost of holding extra oil.[9] Stockowners would receive both the guarantee and capital payments for stocks accumulated during one year and discharged the next. For example, if a refinery held an average of 110 barrels of oil in 1982 and 100 in 1983, it could receive a carrying charge of roughly $7 a barrel for the ten extra barrels carried in 1982 and sold in the following year, assuming no change in the world oil price. If the price fell from $33 to $28 a barrel, the government would pay the firm an additional $5 a barrel. If the world oil price rose to $40 a barrel, the government would pay only $2 ($7 capital payment minus the $5 increase in the price of oil). If the government wished to extend the program beyond one year, it could provide the same guarantee in 1983-84, while paying out the capital subsidy in 1983 or carrying it forward to the future. In this example, the firm could then cash in on its ten barrels in a later year, or perhaps build further stocks before selling.

While this proposal may sound complex, it endeavors to accomplish three simple objectives. First, it removes the financial disincentive against holding higher stocks. Second, it overcomes many of the problems encountered with a straight tax credit, such as fixing the base. Third, government payments are deferred until after the country has received the insurance benefits of higher stocks. Moreover, government payments are high only if the country escapes an oil interruption during the period; if prices rise sharply, government liability rapidly disappears. The program's major disadvantages arise from its novelty and budgetary uncertainty. The untried notion of entering into arrangements in 1982 for a program that will not make actual payments until the end of 1983 may be difficult to present in Congress. In addition, if the program were extended beyond 1982-83, the government would face a growing contingent liability which could be extremely large if oil prices were to fall during the period. Finally, as with the traditional tax credit, firms would be in a position to capture windfall profits on stocks subsidized by the program.

Options Aimed at Permanent Private Stocks

While the previous subsidy schemes could be made permanent, they lend themselves more to temporarily building up stocks. If a permanent reserve of private stocks is considered an important national goal, then mandating stock levels appears to be a more manageable option.

6. Mandatory stockpiling. Section 156(b) of the 1975 Energy Policy and Conservation Act (EPCA) gives the President authority to compel U.S. refiners and importers to hold emergency stocks equivalent to no more than 3 percent of either their annual throughput or imports. Three percent of 365 days is approximately eleven days, with eleven days of throughput equal to about twenty-seven of imports. Hence, existing legislation allows the President to establish an emergency private sector reserve. These reserves would presumably be segregated from normal operating stocks to facilitate adequate monitoring, and the President would have the power to order that they be drawn down. The cost of holding the stocks would be borne by the oil companies and passed on to consumers. Such an option has precedent since most European countries already employ mandatory requirements, usually on the order of 90 days of imports.

The mandatory stockpiling option has a number of advantages. It provides a predictable way to build stockpiles. The costs of the program are correctly passed on to oil consumers, thereby reflecting the social cost of the oil they purchase. Budget costs would be reduced as well.

The biggest disadvantage is that virtually no one has seriously suggested using the EPCA authority, even in the Carter Administration. The Reagan Administration and the oil companies would be unlikely to view this option favorably, nor has any member of Congress advocated the idea. In addition, since some firms normally hold higher inventory levels than others and have different capital structures, this proposal could be inequitable to some firms. Finally, the mandatory requirement does not avoid some of the administrative problems posed by incentive schemes. Defining and monitoring each refiner's level of operating versus emergency stocks could become a bonanza for accountants, but it may not add much to the nation's oil stockpiles.

7. Mandatory Stockpiling with Subsidy. In order to reduce some of the political opposition to mandating stockpiles, the government could subsidize all or part of the oil companies' interest and storage costs associated with meeting the requirement. This option would be designed to dampen the opposition of oil companies and of consumers not wishing to pay higher prices, while preserving the predictability of a mandatory system. Yet, it would not necessarily improve the equity of the system, since the tax position and opportunity costs of firms will differ. Finally, such relief would generate new costs to the government.

Option Aimed at Establishing a Mechanism to Involve Oil Companies in Stockpiling Decisions

8. The Public-Private Corporation. The potential management and political problems inherent in managing a central reserve are a reason for looking at an entirely different institutional structure. Many of the previous options merely accelerate reserve fill, but do nothing to change the basic management system. The two mandatory stockpiling options aimed at creating a permanent strategic reserve in the private sector recognize the desirability of depoliticizing reserve decisions and creating a more flexible response to interruptions. Yet they do not address the vexing problem of coordinating public and private responses to interruptions, nor do they appear to be politically feasible. Effective coordination could go a long way

towards reducing the panic inventory building that generally accompanies an interruption.

One possible mechanism to coordinate stock use between government and industry is a joint public-private corporation which would store oil and manage drawdowns during an interruption. Such a corporation might hold and manage anywhere from one-fourth to one-third of all emergency stocks. These stockpiles would constitute a flexible reserve at the outset of an interruption, which could be used to quell panic, blunt initial price increases, and assure access to crude for the most directly affected refineries. The centrally managed SPR would be available to back up the corporation during truly large interruptions.

The corporation would be modeled after the public-private corporations currently existing in the Federal Republic of Germany, Switzerland, and the Netherlands.[10] It would borrow funds to purchase oil and assess oil industry participants for operating and interest costs. In order to raise money initially in private capital markets, the corporation's debt could be guaranteed by the federal government, or part of the SPR oil could be transferred to the corporation as equity. Oil purchased by the corporation could also serve as collateral for loans. Refiners would make annual payments to the corporation in proportion to their annual throughput, and perhaps weighted according to imports. This proposal differs from the mandatory stockpile proposal in that firms are no longer required to put up their own capital to buy oil, but rather are only assessed for operating costs.

The corporation would serve a number of functions. It would purchase and hold oil as an agent for companies. In this sense, it would act as a financial intermediary. It would decide as a corporate body on how this oil would be released, with one of its missions being to reduce panic stockbuilding at the outset of an interruption. Finally, it would insure each company against disproportionate damages during an interruption. If a particular interruption cut off access to crude oil for some refineries, stockpiled oil could be distributed to these companies on a temporary basis.

Such a corporation could fill many gaps in our current emergency preparedness management structure. But in order to do so, its management must be credible, insulated from government, and responsible to a broad public interest. Most likely, the corporation's board would need to consist of some representatives chosen by the industry and some chosen by the President. The oil companies have operational control of the refining and distribution system. Hence, for the sake of maximum efficiency in responding to an interruption, they should have an important voice in deciding on withdrawal strategies. The addition of government and private representatives should ease fears about collusion. By relying upon the expertise of the oil industry and by insulating corporation decisions from government,* many of the management pitfalls of a centralized federal reserve could be avoided, thereby allowing the corporation to respond quickly and efficiently at the outset of an interruption.

The corporation option has many positive attributes, at least in theory. It could provide a mechanism for coordinating government and private stockpiling efforts. It could partially insulate decisionmaking on stock withdrawals, and even filling, from domestic and international political pressures. It could augment the nation's strategic stocks without direct claims on the budget. And, it could help individual firms in adjusting to abrupt cut-offs in supply.

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* In creating an independent decision-making body, the role envisioned for the corporation is analogous to that of the Federal Reserve Board. (This observation is made to help the reader understand the decisionmaking structure. Considering the current level of interest rates, the authors would not use this example as an argument in favor of an oil stockpiling corporation.)

But the drawbacks may also be substantial. First, a basic hope for the corporation may turn out to be unrealistic: while it is suggested as a solution to a host of management problems faced by current institutions, the corporation might also amount to replacing one flawed institutional system with another. In practice, the corporation may not offer independent and decisive action, but rather, could wind up relying on the federal government to enunciate national stock policy. In addition, the creation and implementation of successful new institutions takes time. The idea of a Synthetic Fuels Corporation was born in the summer of 1979; in the winter of 1982, the corporation remained at a formative stage. Finally, it is difficult to find any kind of support for such a corporation in the United States. In the Federal Republic of Germany, its political impetus derived from industry opposition to a mandatory stockpiling requirement. In the United States, oil companies would probably oppose the corporation since they have little reason to fear the enactment of mandatory requirements.

Comparison of the Options

One option not discussed in this cornucopia is the status quo. After all, the status quo requires no new investment of funds, management attention, or political capital. If no crisis occurs over the next decade, doing nothing might appear to have been an acceptable choice. But looking ahead, it is necessary to assess how likely another supply disruption is and how extensive the damage might be. It is the same kind of assessment we all make in choosing to buy life or fire insurance.

The risk of inaction is large. The cost of each of the last two oil interruptions was in the hundreds of billions of dollars, while the price of holding an additional 150 million barrels of oil is in the neighborhood of $1 billion annually. Such a reserve would minimize the economic impacts from an oil interruption, buy time for diplomacy, and help the western alliance to weather the storm of an oil shortage. The United States plans to spend over $300 billion annually on national defense by 1985; a total of $2.5 billion is authorized for the rapid deployment force in 1982 and 1983. One billion dollars a year does not seem like a high price for the type of economic and political insurance offered by the strategic reserve. Most observers agree that one or more oil interruptions are likely in this decade, and these might be much more severe than their two moderate-sized predecessors.

Even if one concludes that more insurance is preferable, the choice of the best policy is not easy. To choose a course of action, one must consider the price, both in terms of annual budget costs and total program costs. But even more important, one needs to think carefully about what objectives are sought and how feasible each of the options is in achieving the chosen objective. If lack of storage capacity, for example, is the only concern facing decisionmakers, then either government purchase of steel tanks or leasing of storage capacity would be acceptable options. Yet, the costs of purchasing oil require greater federal borrowing. If the reserve were filled at 300 thousand barrels per day instead of the currently planned 200 thousand barrels per day, the extra fiscal year 1983 costs would be over $1 billion. If, however, the Administration and Congress concluded that the management advantages of the current system outweigh the near-term budget costs, then one of these options could be chosen. Of the two, leasing space looks more attractive than government purchase of steel tanks. The latter option should be considered only if lower cost alternatives are not uncovered in soliciting bids, or if the oil is to be stored in tanks for an extended time.

If concern heightens over SPR borrowing requirements, then two general options are available to overcome physical constraints with minimum budgetary impact. Competitive leasing of stockpiled oil, with the option to purchase at a later date, appears feasible and could be accomplished with minimum disruption to the program. Budget costs would be deferred as well. In contrast, the incentives for private stocks suffer from significant defects: the familiar tax credit would be difficult to structure, and the results are uncertain. The more sophisticated price guarantee for surplus stocks may be less complicated, but its novelty and unpredictable cost could be serious political drawbacks.

If the goal is to create a permanent private sector reserve, then the mandatory fill option, with or without federal assistance, is technically feasible. Politically, however, there is virtually no support for such a requirement in the United States. The three previous administrations have shown no interest in using the EPCA authority, and the current administration would probably find it particularly unacceptable.

The public-private corporation suffers from some of the same defects. Unlike the mandatory stockpiling proposal, however, there is less demonstrated hostility. Moreover, the corporation serves a much wider range of objectives — such as creating a forum for industry-government cooperation on stockpiles and a mechanism for joint oil company insurance against small interruptions.

In many respects, the best options are at the two extremes. If the goal is to fill the SPR more quickly by overcoming capacity constraints, leasing of space or leasing stored oil are both feasible and sensible options. At the other extreme, the public-private corporation offers a variety of useful features that are worth pursuing. Between these options are those designed to build up private stocks, by either incentive or fiat. Yet the economic incentives may be too complicated and unpredictable; the mandatory schemes, politically unacceptable. For what they are designed to accomplish, the leasing or corporation options appear to make the most sense.

These two options are at much different levels of readiness. The leasing options could easily be tested by a Department of Energy solicitation of bids for storage space and for oil itself. Depending on budget conditions and the results of the solicitation, one of the two leasing options could be considered as a serious contender for improving SPR readiness in relatively short order.

The corporation option requires both serious analytical work and a means of testing its political feasibility. Thus far, the oil stockpiling corporation has failed to capture the attention of two administrations and the Congress. It has not even received the courtesy of criticism and controversy. Yet, the government must ultimately confront the issues of managing the strategic reserve and coping with continued budgetary crises. The crude oil access problem will not go away, and it could ultimately saddle the United States with an allocation program. While the authors are reluctant to suggest that this new institution would be a cure-all for such troublesome issues, the corporation is certainly an option that could serve many objectives. It is one of few ideas designed to improve management of emergency reserves and reduce political pressure during interruptions, provide a mechanism for cooperation between the public and private sectors, and give greater responsibility to the oil industry in coping with oil shortfalls. With further analysis and refinement, a stockpiling corporation may emerge as the most promising bridge between a centralized strategic reserve and the private sector.

REFERENCES AND NOTES

1. Congressional Budget Office, "The World Oil Market in the 1980s: Implications for the United States" (Washington D.C., 1980), p. 74.

2. For an overview of this strong performance, see U.S. Comptroller General, "Strategic Petroleum Reserve: Substantial Progress Made, but Capacity and Oil Quality Concerns Remain," Report to the Congress of the United States (Washington, D.C., 31 December 1981).

3. U.S. Department of Energy, Monthly Energy Review (Washington, D.C., December 1981), pp. 30.

4. ibid., pp. 30-31.

5. U.S. Department of Energy, "Strategic Petroleum Reserve Acceleration: Report to the Secretary" (Washington, D.C., July 1981).

6. See Sobotka & Co., "Federal Subsidies to Industry to Increase Oil Stocks," for U.S. Department of Energy, 1980; and Evaluation Research Corporation, "Inventory Management in the Petroleum Industry," for U.S. Department of Energy, 1978.

7. Throughout this paper, the holding costs of oil are taken from Exxon Corporation, "World Oil Inventories," Exxon Background Series, August 1981, p. 14.

8. ibid., p. 6.

9. The authors are indebted to Bill Hogan for the scheme developed in this section.

10. For a discussion of stockpiling policy in these nations, see E.N. Krapels, Oil Crisis Management: Strategic Stockpiling for International Security (Baltimore: Johns Hopkins University Press, 1980); for a detailed outline of the elements of a public corporation in the United States, see S.D. Goldberg and H. Seidman, The Government Corporation: Elements of a Model Charter (Washington, D.C.: Public Administration Service, 1953).

Harvard Energy Security Program
Discussion Paper Series

Alm, Alvin L. and Edward N. Krapels, "Building Buffer Stocks in a Bear Market: Policy Choices for Emergency Oil Reserves," Discussion Paper Series, Kennedy School of Government, Harvard University, March 1982, #H-82-01

Energy-Security Related Papers
in the
Energy and Environmental Policy Center Discussion Paper Series

Hogan, William W., "Import Management and Oil Emergencies," Discussion Paper Series, Kennedy School of Government, Harvard University, September 1980, #E-80-08

Berman, Jonathan, "A Summary of Contingency Planning for Energy Emergencies," Discussion Paper Series, Kennedy School of Government, Harvard University, January 1981, #E-81-01

Weiner, Robert, "The Oil Import Question in an International Context: Institutional and Economic Aspects of Consumer Cooperation," Discussion Paper Series, Kennedy School of Government, Harvard University, June 1981, #E-81-06

Hubbard, R. Glenn and Robert C. Fry, Jr., "Macroeconomics and Oil Supply Disruptions," Discussion Paper Series, Kennedy School of Government, Harvard University, June 1981, #E-81-07

Hogan, William W., "Energy and Security Policy," Discussion Paper Series, Kennedy School of Government, Harvard University, September 1981, #E-81-09.

Berman, Jonathan, "Rebate Strategies for an Oil Emergency," Discussion Paper Series, Kennedy School of Government, Harvard University, December 1981, #E-81-12.

Birdsall, Thomas H., "Should Environmental Standards be Relaxed During Oil Supply Disruptions? Theory and Policy Recommendations," Discussion Paper Series, Kennedy School of Government, Harvard University, January 1982, #E-82-01.

Hogan, William W., "Policies for Oil Importers," Discussion Paper Series, Kennedy School of Government, Harvard University, February 1982, #E-82-02.

Senator MATSUNAGA [presiding]. Thank you, Mr. Alm. I certainly appreciate your testimony as we have the others who have testified before you.

You speak of the tendency of the Government at the outset of an interruption to increase a buildup of stocks in reserve and you also say that our experience in 1979 showed that a small oil supply interruption can cause as much as 120-percent price increase in only 1 year. Should we use the SPR during an interruption?

Mr. ALM. I think we should. The 1973 and 1974 interruption was only in the worldwide economic loss of about $300 billion. The 1979-80 interruption resulted in a worldwide interruption to the economic loss of about $600 to $700 billion. The strategic reserve and the reserves of our allies used properly can blunt some of the oil price shock that come from the interruptions.

Therefore it strikes me as terribly important, first of all, to build up the reserves as quickly as possibly; second, decide what mechanisms we would use to discharge them, and, third, work with our allies on cooperation so the steps that the United States takes in managing its reserve will not be offset by contradictory actions by our allies.

Senator MATSUNAGA. Of course, the question would be at what point do we start drawing from the reserves.

Mr. ALM. You mean start or stop?

Senator MATSUNAGA. To start. In other words, you advocate the use of the reserves but then the reserves as you know are primarily intended to meet an emergency or emergencies so that if that is the intent of the SPR, we should not be going beyond a certain point in drawing on such reserves but merely to maintain the price or to contain the price from escalating.

So the question would be at what point do we start drawing in case of an interruption?

Mr. ALM. This is one of the reasons I would advocate the use of a futures market, because you can decide then what price level is acceptable after which the Government would simply have to intervene. You do not have to withdraw oil before you reach that upset side.

Senator MATSUNAGA. Are you just now being employed in that?

Mr. ALM. Futures are being used for No. 2 distillate oil in the United States and I understand, although I am not personally with those, a crude oil futures market in London, but I do know something about the futures market in No. 2 oil in the United States.

Senator MATSUNAGA. Has that helped in stabilizing the price of distillates?

Mr. ALM. Well, it is a different situation. Basically what this particular futures market is is a hedge for fuel oil dealers. It would not particularly stabilize the price. But if you are talking about a situation like an interruption where you have a large auxiliary source like the strategic petroleum reserve, then refiners would know that at some time in the future if the price reached a certain level that additional oil would be released to the market.

That would allow the refiners to draw down on their own inventories or at least not go in the spot market to build up inventories. To me it is a perfect way to quell some of the panic that drives the price up.

Senator MATSUNAGA. Have you at any time offered your proposal or have you offered your suggestion to the administration?

Mr. ALM. We are, as I indicated in my testimony, working on the proposal now. We have discussed it with administration people. We are far from having worked out all of the concepts, how it would work. I have talked to the administration. I have talked to people in the oil industry and others and I have received a generally favorable attitude, also people in the International Energy Agency and other organizations.

Senator MATSUNAGA. Maybe we ought to have the staff look into the details and if you are available we could have the staff speak with you or your assistants.

Mr. ALM. I would be delighted to do so.

Senator MATSUNAGA. Thank you very much. Senator Bradley.

Senator BRADLEY. Mr. Chairman, I don't have a lot of questions. I think Mr. Alm's statement is fairly straightforward. I think he is certainly one of the leaders in emergency preparedness and the committee has looked to him from time to time for advice and he has always been very forthcoming.

Let me just ask one question. Yesterday the President vetoed and the Senate sustained the President's veto of S. 1503. The Senate is then faced, as is the Congress, with what do we do. Do you have any advice?

Mr. ALM. Well, I read in the newspaper today, Senator Bradley, that there is a revived interest in your recycling proposal and I had hoped that that was the case. As I have indicated before to the full committee, first, I would agree with everything that Charles DiBona said in terms of the impact of price controls and allocation during the last interruption. I think the controls created many of the problems.

Senator BRADLEY. Then you were involved with that on a day-to-day basis?

Mr. ALM. I was in the middle of that. I saw it at a very close hand, much closer than I would have preferred. The second point is that if one is going to use the market one simply cannot walk away from the macroeconomic problem. And an oil supply interruption would have a tremendous spike in prices that would result in billions of dollars pouring into the Federal Treasury from the windfall profit tax.

I don't think such a shift from the private sector to the public sector during a period of rapidly rising petroleum prices could have any result but to create recessionary pressures. We simply have got to get the money back into the economy.

Second, from an equity point of view, the impact of central oil price hikes could be devastating to certain groups. I think recycling is absolutely critical if we want to make the market work.

Senator BRADLEY. You are prepared to work with the committee if we head in that direction?

Mr. ALM. Yes, we certainly would.

Senator BRADLEY. What fill rate of the SPR would you urge us to meet?

Mr. ALM. Well, you can choose almost any number, but it strikes me we were able to fill the reserve two times in the past with

300,000 barrels a day. If we can do so we could reach the 750-million-barrel target by 1987. It strikes me that is a reasonable target.

Senator BRADLEY. Mr. Lichtblau was here and his testimony said that we should not look at the 750-million-barrel goal as if it were fixed, because it should be the amount of oil in storage to reflect what our import levels are. If our import levels drop then we don't need 750 million barrels.

Mr. ALM. That is true.

Senator BRADLEY. What is your view?

Mr. ALM. My view is that the energy experts have not been sufficiently clairvoyant to predict import levels very clearly. Oil imports are a little bit like stockpiles. They tend to be in the residual use. When energy use is coming down in general, for example, in the United States you had a 5-percent energy demand growth reduction for 2 years. That translates into about an 11-percent oil demand reduction, which translates to about a 30-percent oil import reduction.

What I am saying is that oil imports could go up quickly. I do not think that that is a sufficient reason not to give up the target.

Senator BRADLEY. OK, good. Would you advocate regional storage?

Mr. ALM. I have not looked into the issue for a long time. When I was in the Department——

Senator BRADLEY. Let us say the Department of Energy puts out its bids and a lot of its offers and a lot of bids come in and some of these are cost efficient and aboveground storage in the Northeast.

Mr. ALM. Well, the question there is if they are in the Northeast, at least if they are in New England, you are probably talking about residual fuel oil.

Senator BRADLEY. I think there are some in New Jersey.

Mr. ALM. New Jersey, presumably if there were available capacity in New Jersey for crude oil that could be refined in New Jersey refineries it strikes me that would make perfectly good sense. But that is different than the concept of a product reserve in a region which I think is not a good idea, but I have not looked at it closely for some time.

Senator BRADLEY. Thank you very much. Thank you, Mr. Chairman.

Senator MATSUNAGA. Mr. Alm, one question. Is it your view that legislation would be necessary to carry out your proposed futures?

Mr. ALM. I am not sure. I have not looked into it to that point. It may be that nothing more than an amendment to the SPR use plan would be sufficient, but I simply have not thought about that question.

Senator MATSUNAGA. I will have staff look into that. If it could be done without legislation it would simply be a matter of convincing the private industry as well as the administration. Otherwise we would have to introduce legislation.

Mr. ALM. I would think that considering the novelty of the idea, we are at least 6 months to 1 year away from having thought through the full implications. I did want to just mention it to the committee, since I was asked to testify, because I think it is an idea that deserves for people to think about.

Senator **Matsunaga**. I think it is a splendid idea, so we ought to explore it.

Mr. **Alm**. I would be happy to work with the committee in that regard.

Senator **Matsunaga**. Thank you very much.

The chairman has left instructions that we will now recess until 1:30 and so if the other witnesses will return at 1:30, we will be happy to hear from them. Thank you for your patience. The subcommittee stands in recess until 1:30 p.m.

[Whereupon, at 12:05 p.m., the hearing was recessed, to reconvene at 1:30 p.m., this same day.]

AFTERNOON SESSION

Senator **Warner** [presiding]. It is now 1:30 p.m. The subcommittee will resume its hearing. To lead off this afternoon is Mr. Carmichael, staff economist, public affairs, Bethlehem Steel Corp. We welcome you and we appreciate your coming down.

STATEMENT OF WILLIAM W. CARMICHAEL, STAFF ECONOMIST, PUBLIC AFFAIRS, BETHLEHEM STEEL CORP., BETHLEHEM, PA.

Mr. **Carmichael**. Thank you, Mr. Chairman. It is my pleasure. Mr. Chairman, and members of the subcommittee, my name is William Carmichael. I am here on behalf of the 67-member companies of the American Iron & Steel Institute, whose membership includes companies that account for 90 percent of the raw steel produced in this country at steel plants in 39 States and 299 communities throughout the Nation.

Mr. Chairman, the American Iron & Steel Institute believes that aboveground tank storage should play a significant role in the expansion of the strategic petroleum reserve to at least the 750-million-barrel level.

More specifically, we believe that the facts indicate that 140 million barrels of aboveground steel tankage should be substituted for an equal amount of inground storage capacity that has been proposed for development at the Big Hill salt dome. This substitution would for essentially the same total cost permit a 3-year acceleration of the achievement of a 750-million-barrel SPR, while at the same time creating a great deal more employment.

In addition, steel tank terminals would allow greater geographic dispersal of the SPR and that is a point we have heard much concern about here today. This would enhance the security of the reserve and it would facilitate the distribution of the oil to the various regions of the country in the case of an actual emergency utilization.

Steel tanks also permit a higher percentage of the stored petroleum to be recovered than does inground storage. In fact, alternative storage uses that are simply not possible with salt dome storage are possible with steel tanks.

I would briefly address certain of these considerations in turn.

In October 1981, the Army Corps of Engineers prepared a comparative cost analysis of 140 million barrels of aboveground steel tank storage versus the same amount of inground storage at Big Hill. The corps considered the cost of both oil and facilities and found the aboveground storage approach to be approximately 3 percent less costly than inground storage at Big Hill, in real, inflation-adjusted 1981 dollars.

A similar analysis of the real facilty and oil costs of steel tankage versus Big Hill was contained in the July 1981 Acceleration Report of the Department of Energy. In contrast to the Army Corps of Engineers, the Department of Energy found Big Hill to be 4.2 percent less costly than steel tankage.

After making reasonable allowances for a degree of imprecision in such estimates and for the fact that the same timeframes considered, the timeframes considered differ somewhat from those that would ultimately be realized, it can be said that steel tanks and Big Hill represent nearly identical total costs.

The schedule for possible completion and filling of an inground facility at Big Hill has been changed so that the full 140 million barrel addition to the reserve would not be available until the end of fiscal year 1990. In contrast, the Steel Plate Fabricators Association estimates that a similar amount of filled, aboveground tank storage could be available at least by the end of fiscal year 1987. They, of course, will speak to that later in their testimony, I am sure, Mr. Chairman.

Quite obviously, that 3-year acceleration would mean that the United States would be afforded the protection of a 750-million-barrel SPR at an earlier date. And since the price of oil will most likely rise during that time period to the end of the decade, that 3-year acceleration would mean that fewer dollars would have to leave the income stream of the American economy to pay for the same amount of foreign oil. That is highly desirable in and of itself.

Another aspect of aboveground steel tank storage that deserves careful consideration is its greater job-creating potential relative to solution-mined storage. According to the Steel Plate Fabricators Association, 392,000 tons of steel, mostly steel plate, would be required to build 140 million barrels of aboveground steel tank storage capacity. That, we in the steel industry know, would translate into no less than 1,580 man-years of work in our industry, primarily at plate mills in Indiana, Texas, Alabama, Illinois, California, and five other States around this country.

But it also means work for coal miners and those who would extract, process and transport the other raw materials that go into the production of steel here in the United States.

The tank fabrication, site preparation, tank erection and other activities associated with the establishment of 140 million barrels of aboveground steel tankage would provide 5,740 man-years of work for welders, electricians, pipefitters, carpenters, engineers, and others.

That is a total of 7,320 man-years of work.

A useful estimate of the number of man-years of work associated with the expansion of the SPR via an inground storage facility at Big Hill does not appear to be available. It is clear, however, that solution-mining is less job intensive than construction of aboveground steel tank storage terminals.

The construction of 140 million barrels of aboveground steel tank storage capacity would create a total of 7,320 man-years of work. If only one-fourth of those jobs were to go to workers in the hard-pressed steel, steel plate fabrication, construction, and related industries who would otherwise be unemployed, State unemployment insurance programs would conservatively be spared paying our almost $5.3 million in unemployment benefits.

The choice between aboveground steel tankage and the Big Hill salt dome has even more significant implications for Federal Government revenue receipts.

As a result of the domestic economic activity that would be generated by the establishment of 140 million barrels of aboveground steel tank storage, the Federal Government would collect, through various sources of revenue, approximately $585.6 million during the facility construction phase. That is $327.4 million more than would be collected if 140 million barrels of storage capacity were instead to be developed at the Big Hill salt domes.

Mr. Chairman, I will close by saying that America's steel companies are ready to produce the steel plate and steel pipe that is needed to construct 140 million barrels of aboveground steel tank storage for the SPR. The men and women of the American steel industry need and would welcome the work.

Senator WARNER. Your proposal, of course, is directed toward what we call phase three permit construction.

Mr. CARMICHAEL. Yes, sir, it is.

Senator WARNER. In your calculations, what range of a price would you use in some of your calculations?

Mr. CARMICHAEL. The price figures for oil were taken from the Department of Energy Acceleration Report of July 1981 and I believe the figures there run about $45 to $47 a barrel, depending on the time period that is looked at. I also used figures, the figures I alluded to for the Army Corps of Engineers. I think their estimates run roughly in the same vicinity.

The differences between those two seem to center on the cost of the steel tank facilities rather than the oil itself.

Senator WARNER. Some of the same then would be predicated on the lower prices we have today, would you say?

Mr. CARMICHAEL. Yes, I think the same concerns that drive the discussion about interim storage, I think, undergird the argument in favor of aboveground steel tank storage, namely, that is the acceleration of the scheduling, availability, and filling of those storage facilities.

Senator WARNER. That has been very helpful testimony and I thank you for coming forward.

Mr. CARMICHAEL. Thank you, Mr. Chairman

Senator WARNER. We will now have Mr. Randall Montgomery, president, Saltville Underground Storage Co. Mr. Montgomery, would you be kind enough to introduce the individuals accompanying you?

STATEMENT OF RANDALL F. MONTGOMERY, PRESIDENT, SALTVILLE UNDERGROUND STORAGE CO., MONTGOMERY, TEX., ACCOMPANIED BY LESLIE GRANDIS, COUNSEL, RICHMOND, VA.; CARL SHERMAN, PROFESSOR, PENN STATE UNIVERSITY; AND LARRY RAUSCHE, NORFOLK & WESTERN RAILROAD

Mr. MONTGOMERY. Thank you, Senator. If I may, I would like to introduce counsel from Richmond, Mr. Leslie Grandis and Prof. Carl Sherman from Penn State University and Mr. Larry Rausche of Norfolk & Western Railroad. In addition to that, there are citizens from the local community in Saltville, Va., that are present in the audience.

Senator, what we would like to talk about today, we filed a statement with you, some of the items that we have heard since we have been here, we perhaps now place a little more emphasis on that we see from the standpoint of utilizing an underground abandoned mine that is in place, ready, and available to use on an east coast State in Virginia.

After several years of search, both on the part of the Department of Energy and ourselves, this is the only abandoned mine facility known to us on the east coast that would be suitable for such storage. This mine is in place, ready to go and a very large facility about 21½ million barrels of oil.

Senator WARNER. I have visited the area and I think it would be interesting if you gave a little historical prospective.

Mr. MONTGOMERY. Thank you, sir. This area was founded on a salt deposit that was first identified by Thomas Jefferson. It is one of the very few salt deposits on the east coast and in fact the salt deposit is very limited in its extent, perhaps one-half of a mile wide and perhaps less than 1 mile long. There were several battles fought during the Confederacy over this salt supply.

In those days they had no refrigeration and the way to preserve food was by salt. So there were several battles fought in the area and it is a very historical area on the east coast. This was the founding of the old Mathis Chemical Co., back before the turn of the century when they made all of the family of chemicals from the salt deposits there in this limited area and the limestone deposits, in the early days, when they quarried this limestone from open surface mines.

In 1950 they had to go underground and for over 20 years this facility was mined from underground and to duplicate that facility today would take perhaps 20 years to duplicate that huge warehouse that is there and existing.

But it eventually became the Owen Mathis Chemical Co., and was a very large chemical complex in the United States but for environmental reasons the plant became uneconomical in the early 1970's and it was the very first town that was closed, town that was impacted because of environmental problems.

Massive Federal attention was directed in that region, in that area to overcome these issues and some of the very first environmental impact consequences of poor industry practices had their laboratory in that area. But the DOE with all of the consultants that they hired did not encounter this large underground warehouse. We happened onto it by strictly serendipity and having spent several years working with the French underground storage companies——

Senator WARNER. I think you are going to have to hold that microphone a little closer.

Mr. MONTGOMERY. Am I doing better, Senator? In having worked in Europe with the French engineering company that worked on the very early strategic petroleum sites for most of the world, we developed a background and the concept of what the strategic petroleum reserve program should be in the eyes of the Europeans.

And the European history is considerably different than the typical American history. And when they developed facilities in that area they were developed on the concept of national security, not on the concept of national convenience, such as our current strategic petroleum reserve program is conceived on.

I suggest to you, Senator, that in the program we have too many eggs in one basket. All of the sites are located in very large underground facilities in the State of Texas and in the State of Louisiana and in the program, there are no facilities on the west coast. There are no facilities on the east coast and the only way that the oil from that reserve can get to the east coast consumers, where most of the population of the United States is located is going around the Straits of Florida and I show to you a map from the Department of Energy's report how they propose to distribute the oil from Texas to the east coast and that is through the Straits of Florida.

Currently NATO is conducting naval maneuvers in the Straits of Florida. They are sending a message, according to the news quote, a message to the Cubans that these waters are vital to the commerce of Europe and the United States.

Also the Caribbean, Reagan's recently stated Caribbean policy makes that route very vulnerable to interruption. Those in this room that are old enough to recall World War II know that that system will not work.

Senator WARNER. It is amusing there are fewer of us every day.

Mr. MONTGOMERY. Yes, sir. I heard a number the other day, the last time I heard it, it said only half of the people remember World War II. I was shocked.

Senator WARNER. Not to digress, but I served in the navy in World War II and according to statistics, only 70 percent of the people today in Germany were alive to see part of that. That is one of the reasons we have peace movements now. But we will not get into that. Go ahead.

Mr. MONTGOMERY. And I suggest another map, Senator, that we show the distribution of crude oil in the United States, this map shows the route of the crude oil pipelines and you will note from that map that the east coast has no pipelines other than the one that goes from the State of Maine up to the refineries in Canada.

So therefore in the event of an interruption of the shipping lanes of the United States, the east coast would be completely paralyzed. A similar scenario occurs for the west coast and Hawaii certainly. We are very vulnerable under periods of that time.

And therefore we think the solution to the problem is to have many sites dispersed throughout the United States in order to plan for such a contingency. They continue to have programs on watching the facilities where they are at and I predict that they will continue to do so.

An intricate part of the system are our pipelines as much as 23 miles out into the Gulf of Mexico, which are subject to terrorist activities and shutting down the system in the event of a national emergency.

Further, there are only about three or four ship loading docks available to load the oil in the event of a national emergency to move it to the east coast, But getting back to the nuts and bolts of the facility itself, if all of the thoughts about buying this oil and the volume and accelerating the purchasing and they put it in temporary storage, if we don't have the storage where it can be used and where the distribution system can function, it is not worth anything in the ground.

It is absolutely the largest insurance policy the Federal Government has ever purchased and I would say to the people who are familiar with risk management, if they took a look at the facility they would be aghast to see the lack of flexibility that the system has in it for serving the east coast, for serving the west coast.

The concept of developing it on the basis of national convenience as opposed to national security is immense, and I think that the policy decisions that the Department of Energy has received in regard to this function is not all under national convenience. And I suggest the solution is someone needs to step in and improve, have some input into the policymaking decisions.

They are working entirely on cost effectiveness programs and I am not certain that all of their logic to date is being properly focused.

Another example, another arm of the Federal Government, the Department of Defense has requested some $33 billion be added to the budget to be used mainly to protect the Middle East oil. Well, if you take that figure and divide it into the oil that is imported into the United States, that means that the taxpayers of this country and the consumers of this country will be paying almost $100 a barrel for that oil.

Senator WARNER. That is a very, very good point that you make. We are dealing with that budget right now, tomorrow and Monday. I like that and I would like to put it in some other testimony.

Mr. MONTGOMERY. Thank you, Senator.

We are also rather amazed—I think amazed is the right word—I was absolutely amazed to hear this morning that U.S. Senators were not able to get communications from the Department of Energy.

Senator WARNER. Don't be totally dismayed by that observation. There are reasons for it.

Mr. MONTGOMERY. We have been knocking on the doors for about 4 years and I will have to say that the current administration has been more responsive to our requests. We also note that the General Accounting Office has recommended that the strategic petroleum reserve office seek alternate sites due to the delays encountered in the construction of the salt dome storage.

And we have a site that can be ready and available based on the fast-track concept and based on the way we do it in industry, it could be tested and ready to go in 6 months. And we can convert that facility and have it ready for industry purposes for 50 cents a barrel as compared to figures we just heard a moment ago of $50 a barrel and as compared to the budget request, that included the price of oil—I have to correct that statement.

Senator WARNER. Would you inform us now as to the extent that the DOE has given any consideration to this proposal?

Mr. MONTGOMERY. We received a letter—on February 6, I received a letter rejecting our proposal.

Senator WARNER. Could you take me through the procedures they followed in considering your proposal? Did you meet with them?

Mr. MONTGOMERY. After about 4 years we finally were successful in obtaining a meeting with the Department of Energy, thanks to the efforts of the people on the east coast and the people involved in your office and other areas.

Senator WARNER. When did that meeting take place?

Mr. MONTGOMERY. It took place here in Washington in October.

Senator WARNER. Of 1981?

Mr. MONTGOMERY. Yes, sir. And we met with Undersecretary Jones, who no longer is with the Department, and he was very courteous and very polite and since that time he has resigned and gone on to other situations. We have received communications from Secretary Edwards, Who has offered his services, but he has stated that his staff is advising that he should not take the time to be involved in the Saltville program.

Senator WARNER. Have you got that letter with you?

Mr. MONTGOMERY. I don't have it with me, no, sir.

Senator WARNER. Consult with your counsel. I suggest that it be made a part of the record.

Mr. MONTGOMERY. It was a very gracious letter. I believe counsel has it here and we reviewed it as being warmly received. Previous to this time we were not even able to get responses from the Department of Energy. What we think is a very valid sincere approach to try to help the program.

Senator WARNER. Would you ask your counsel to provide for the record exactly how your submission was considered by the Department of Energy?

Mr. MONTGOMERY. All right, sir. Thank you.

In the response that they sent us they were attempting to be very forthcoming and they cited economic figures and logic on which the program is based and we think they are invalid and incorrect assumptions in logic. And we hope that we have the opportunity to sit down and discuss these problems with them. We think it is in the interest of the national security to do so.

Senator WARNER. You are familiar with the DOE criteria contained in the testimony before this subcommittee. The goals of the SPR is to have it located in close proximity to the existing petroleum institution. Are you able to meet that?

Mr. MONTGOMERY. Yes, sir, we are. We have looked at the program very closely and we have run economic analysis on it and we are convinced that this redundancy needs to be added to the system and we think railroad tank cars do that. We think it is vital to these facilities to be underground and to be secure and to be in isolated locations free from terrorists and other types of activity.

That is what this type of facility does. We think the maneuverability and the flexibility to distribute the oil by railroad tank cars is that added redundancy that one needs in such a system. In times of national emergency if anything can go wrong it will. So the more redundancy we have the better.

Senator WARNER. How do you couple them to your scheme of refining capability?

Mr. MONTGOMERY. Their what, sir?

Senator WARNER. How do you couple them into your scheme of refining capability?

Mr. MONTGOMERY. The east coast refineries, which represent about 1,600,000 barrels a day are about 10 percent of the Nation's capacity, as it receives its oil only by ships, so this would go by rail car and by barges in the intercoastal water canal, protected waters, to those refineries.

Senator WARNER. What about the value, that is in terms of the taxpayer's dollars.

Mr. MONTGOMERY. We say that the facility can be constructed at a cost to the American taxpayers of 50 cents a barrel, compared to Big Hill Texas salt dome of about $5 a barrel.

Now, each one of the facilities has to add the cost of distribution to that and we think our cost of distribution to east coast refineries would be substantially less than that from the Texas Hill salt dome if ships were available in times of a national emergency to get to the east coast and we suggest that they would not be.

Senator WARNER. You need not go over it in detail. Is there documentation you can give to the full committee as to your concepts on how any leaching would be prevented in this system?

Mr. MONTGOMERY. Yes, sir. It is a very straightforward technological concept. I don't think any experts would have any problem with it at all.

Senator WARNER. State of the art?

Mr. MONTGOMERY. Yes, sir. And I would suggest to you that our oil would be pumped from 400 feet as compared to 4,000 feet from a typical salt dome and the expense of doing such is enormous. For example, to make comparable space in the salt dome, in Big Hill salt dome in Texas, would require the transportation and the circulation of 280,000 barrels of water. pump it and circulate it at 4,000 feet in depth and then pump it out to sea as much as 23 miles to dispose of this objectionable brine.

And also each time you displace the facility in a salt dome, you have to displace it with water. It is what you call the wet process. The Worthy Mine concept of moving the oil would be what you call a dry process. We would not be handling any water, certainly not brine water.

So the order of magnitude for using electrical energy to lift this oil is many, many times more for the salt dome. In fact, we will have some engineering studies for you if you are interested in them. We suspect it is on the order of magnitude of, from the whole reserve facility, of burning up about 10 percent of the reserve just to do the work. And that would be imported oil.

Senator WARNER. Counsel for the minority brought this to my attention. On page 5:

Based on our preliminary investigations, when the reservoir is in a storage operation mode, it will be necessary to pump water from the mine at a variable rate of from 30 to 300 gallons per minute. If necessary, the water will be treated prior to being released into the surface water. Injection of this water into deep underground reservoirs that are suitable for such purposes is an alternative disposal mode.

Mr. Montgomery. Well, that volume of water is equal to about what 20 or 30 families use in a day. It is a very small volume of water and that is all the water we would have to handle as compared to the millions of barrels on the gulf coast. Yes, there are facilities to dispose of it. We have Ph. D.'s who have examined these problems and we have answers for them.

It is a state of the art, very straightforward. It is conic water. It has no objectionable minerals in it. We have had detailed chemical analysis made of it. In fact this facility has been before the State regulatory bodies in the Commonwealth of Virginia for over 4 years. We have not encountered any insurmountable barriers to this point.

We have resolutions from the Legislature of the Commonwealth of Virginia supporting this proposal and concept. We have resolutions from the local communities supporting the concept in principle and other industry people who have looked at the facility think that it has feasibility.

Senator Warner. What is your understanding of why the Department of Energy rather summarily put this off to the side?

Mr. Montgomery. I don't know and it certainly was not because their—they recognize that we have background and have had some experience in it. I think they want to stay with salt and I think that that is an error in judgment.

Senator Warner. Did they come down to see this facility?

Mr. Montgomery. No, sir.

Senator Warner. They may be down.

Mr. Montgomery. Thank you, sir. I appreciate that.

Senator Warner. I have got a pretty good summary of this situation. Is there anything further you want to add?

Mr. Montgomery. No, sir.

Senator Warner. I have read through all of your testimony very carefully.

Mr. Montgomery. The only thing we would like to stress, sir, is the concept of national defense and redundancy and regional supply.

Senator Warner. I am becoming more and more persuaded to the regional issue. Should the record contain any of the comments of your colleagues here?

Mr. Rausche. My name is Larry Rausche and I am director of market research and planning for merchandise for the Norfolk & Western. And I do not have any prepared remarks, but I do have a few comments to make regarding the rail transportation element of Mr. Montgomery's proposal.

There is a railroad running between the Port of Norfolk and the town of Saltville today called the Norfolk & Western. It is a first-class railroad and we are in place today and in a position to handle the proposal contemplated by Mr. Montgomery.

Senator Warner. Is this near one of your main lines?

Mr. Rausche. Yes; it is right off the main line.

Senator **Warner**. The Government has now decided to turn on the sound system. They do believe the chairman is interested in it. Thank you very much.

Mr. **Rausche**. We wanted to add here today that NW has long experience in moving heavy tonnages through mountainous terrain, which we find between Norfolk and southwest Virginia. That is evidenced by our handling of Applachian coal from Virginia and West Virginia. We believe that we can provide the transportation that would make this proposal realistic.

We also feel that the concept of rail unit train transportation as embodied in this proposal is very feasible and cost competitive, when all costs are considered with other alternative means of storage. The concept of rail unit train and of liquid bulk products is in use today in other parts of the country.

It is a proven technology. It has been applied successfully elsewhere and could be applied successfully here. NW is very much interested in this and anxious and willing to participate if the project is good.

Thank you for the opportunity to address this group.

Senator **Warner**. Thank you. I am pleased to hear about that unit train concept. Any other comments? Thank you very much, gentlemen.

Mr. **Montgomery**. Thank you, Senator.

[The report submitted by Mr. Montgomery follows:]

SUITABILITY OF
WORTHY MINE SITE AS AN SPR ALTERNATIVE

Project Technical Liaison Associates, Inc.
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March 23, 1982

ABSTRACT

Project Technical Liaison Associates, Inc. (PTL) has examined the merits of the Worthy Mine as a viable alternative in the ongoing search for suitable sites involving the storage of crude oil for the Strategic Petroleum Reserve (SPR). We find the assumptions of Saltville Underground Storage Company (SUSCO) to be valid and we believe that upon examination the Department of Energy will add the Worthy Mine Site to the SPR.

This preliminary report is a prelude to a more extensive document that will be forthcoming in four to six weeks from the above date.

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1.0 INTRODUCTION

This is a preliminary report regarding the suitability of offering the Worthy Mine in Smyth County, Virginia as an option to the exclusive storage of SPR crude oil in the Gulf Coast area. While not complete, it is hoped that this preliminary report will shed new light on the potential of the Worthy Mine as a viable storage candidate for the SPR.

Assumptions regarding environmental, engineering, costs and other areas are briefly stated to facilitate greater understanding of the concept and set the parameters for the final report.

2.0 BACKGROUND

The Strategic Petroleum Reserve (SPR) is crucial to the Nation's efforts to establish protection from oil embargoes or temporary oil shortages. To implement this program, a plan is needed for a reserve of 500 million barrels to be stored by December, 1982. Moreover, in June of 1980 the President approved the Energy Security Act (P.L. 96-294) of which Title VIII of the act requires that the President fill the SPR at an average rate of at least 100,000 barrels per day for fiscal 1981. Later, in August of 1981, the Omnibus Budget Reconciliation Act (P.L. 97-35) was passed which requires that the President fill the SPR at an average annual rate of 300,000 barrels per day until the SPR reaches 750 million barrels.

By the end of fiscal year 1981, the SPR contained approximately 199 million barrels of oil. DOE's storage expansion plans provide for an average fill rate of 189,000 barrels per day during fiscal year 1982 through 1989, depending on existing construction schedules at some SPR sites.

The quality of SPR oil, in the event of a drawdown, is important in planning the production of refined products within rfefinery design parameters. By December 1, 1981, 40.3 million barrels of crude received by the SPR were of the heavier types. What impact the change of quality portends for the mix of oil products available at this time is not known.

3.0 DISCUSSION OF KEY ASSUMPTIONS

In order to meet the objective of the Strategic Petroleum Reserve (SPR), adequate storage sites for high sulphur crude oil with relatively easy access to East Coast refineries must be identified and approved by the Secretary of Energy. High sulphur crude oil is needed by East Coast refineries for maximum utilization of their facilities.

The analytical rationale for determining where (vis-a-vis configuration options) and how much it will cost (vis-a-vis measures of effectiveness) to store part of the SPR for use as a replacement of the East Coast's interrupted fuel oil imports during a possible embargo includes the assumption that East Coast storage sites are highly desirable in the event of a national emergency due to the relative vulnerability of East Coast supplies.

3.1 Crude Oil Storage Limited to Gulf of Mexico

It is assumed that exclusive storage of crude oil in salt caverns in the Gulf of Mexico area will not meet SPR requirements in terms of protection of East Coast refinery capacity. SPR requirements may be frustrated by availability of U.S. flag carriers for transportation to East Coast facilities and the requirement for adequate response time. Jones Act waivers may be required to facilitate SPR requirements.

3.2 Cost Comparison

It is assumed that the Worthy Mine in Smyth County, Virginia, will compare favorably in terms of costs when compared to already existing Gulf Coast storage facilities. Development cost estimates regarding the Worthy Mine are more favorable than any identified site.

3.3 Adequacy of Storage and Drawdown Capability

It is assumed that the Worthy Mine's capacity of 21.5 million barrels of storage is equal to or greater than other proposed storage facilities. It is also assumed that the drawdown capability of the mine storage site falls well within the objectives set for the SPR.

3.4 Storage Compartments

It is assumed that turnover (drawing down and replacing stored product) can be adequately performed without reducing storage protection. There is another advantage to the Worthy Mine in that it can be segregated as to storage compartments to facilitate this task.

3.5 Environmental Impact

Worthy Mine is located in a rural area where no significant environmental consequences are currently evident. Worthy Mine has received approval in concept, pending the review of detailed data, from several officials on the local and state level. Worthy Mine, an abandoned limestone facility, is physically and environmentally superior to limestone mines in Lexington, Kentucky, and Ironton, Ohio, which have already filed Environmental Impact Statements.

3.6 Time of Availability

It is assumed that the Worthy Mine can be made quickly available. There is reasonable certainty that a Certificate of Competency can be obtained within a few months. A minimum of site preparation both below ground as well as surface facilities would be necessary to bring the Worthy Mine to a state of readiness. At this time Worthy Mine is filled with water and can be quickly drained. No excavation below ground is necessary.

3.7 Operability

It is assumed that the Worthy Mine site will be served by a unit train system of sufficient size to facilitate adequate movement from the mine site to East Coast refineries. The availability of rail tank cars at this time is good. Additional rail tank car capacity can be quickly added by private industry on relatively short notice.

4.0 SUMMARY SITE DESCRIPTION

Preliminary geologic and engineering studies indicate that the Worthy Mine is capable of storing an estimated 21,500,000 barrels of hydrocarbons. The Mine has a history of structural competence, and the shape is such that it may be comparmentalized to permit the storage of more than one type of hydrocarbon.

The Worthy Mine was opened January 1, 1950 as a source of limestone for a chemical plant and was operated continuously until 1971 when the plant was closed. The underground workings of the Mine cover no more than 100 surface acres.

The Mine shaft is 434 feet deep from a surface elevation of 2075 feet MSL. The Mine was operated with three levels at 1749, 1850 and 1909 feet MSL respectively. The roof is 150 feet below the surface. The water level is 95 feet below the surface. Based on our preliminary investigations, when the reservoir is in a storage operation mode, it will be necessary to pump water from the Mine at a variable rate of from 30 to 300 gallons per minute. If necessary, the water will be treated prior to being released into the surface water system. Injection of this water into deep underground reservoirs that are suitable for such purposes is an alternative disposal mode.

The existing configuration of the Mine is such that no major additional mining is necessary to prevent trapping of crude oil. If it is determined that compartmentalization is not desirable, it may be necessary to drive one or more short drifts to connect the two principal mined-out areas. In the event compartmentalization is desirable, a new 150 foot entry for installation of pumps will be drilled.

The cost to convert the Worthy Mine is less per barrel than that reported for Gulf Coast facilities.

TABLE 1

COST SUMMARY

NEW MINED CAVERNS AND EXISTING MINES
($ in Thousands)

GULF COAST SALT DOMES/CANADIAN SALT FORMATIONS
($ in Thousands)

Site	WESTBROOK	NEW BEDFORD	FALL RIVER	WABANA	SENECA LAKE	WORTHY MINE	STRAIT OF CANSO	BIG HILL	BRYAN MOUND
Quantity	20 MMB	20 MMB	20 MMB	18 MMB	14.5 MMB	20 MMB	20 MMB	20 MMB	20 MMB
Land Acquisition	1,300	540	1,300	2,700	3,300	N/A	4,025	5,015	3,715
Storage Site	116,123	112,761	114,197	68,755	22,414	16,555	31,365	44,071	41,045
Pipeline	6,716	1,765	1,475	1,838	--	6,024	16,868	31,296	2,300
Terminal	9,150		31,364	22,743	22,115	2,000	34,280	36,825	33,865
Engineering and Administration	15,839	17,507	16,622	11,125	5,640	2,000	9,902	13,463	9,308
Subtotal	149,128	163,937	156,437	106,533	55,944	26,579	96,440	130,670	90,593
Contingency	26,854	29,185	28,084	18,365	8,736	2,549	13,019	12,566	8,688
Total	175,982	193,122	184,521	124,898	64,680	29,128	109,459	143,236	99,281
Annual Operation and Maintenance	1,814	1,756	1,760	932	10,665	7,452	1,240	1,240	1,240
Initial Fill	4,369	1,070	1,060	409	15,782	3,741	3,086	3,013	3,618
Annualized Drawdown and Refill	786	171	169	161	3,103	748	464	671	544

*Seneca Lake distribution via unit train to Port Albany

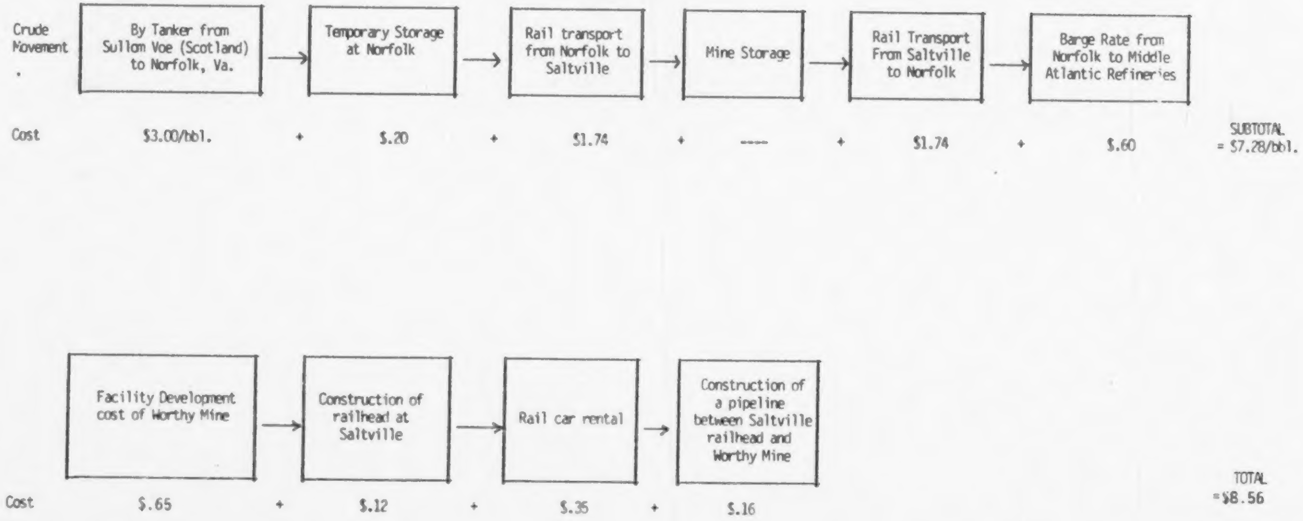
SOURCE: D.O.E. Report, September 1978

FIGURE 1

PRO FORMA COST ESTIMATES RELATING TO WORTHY MINE

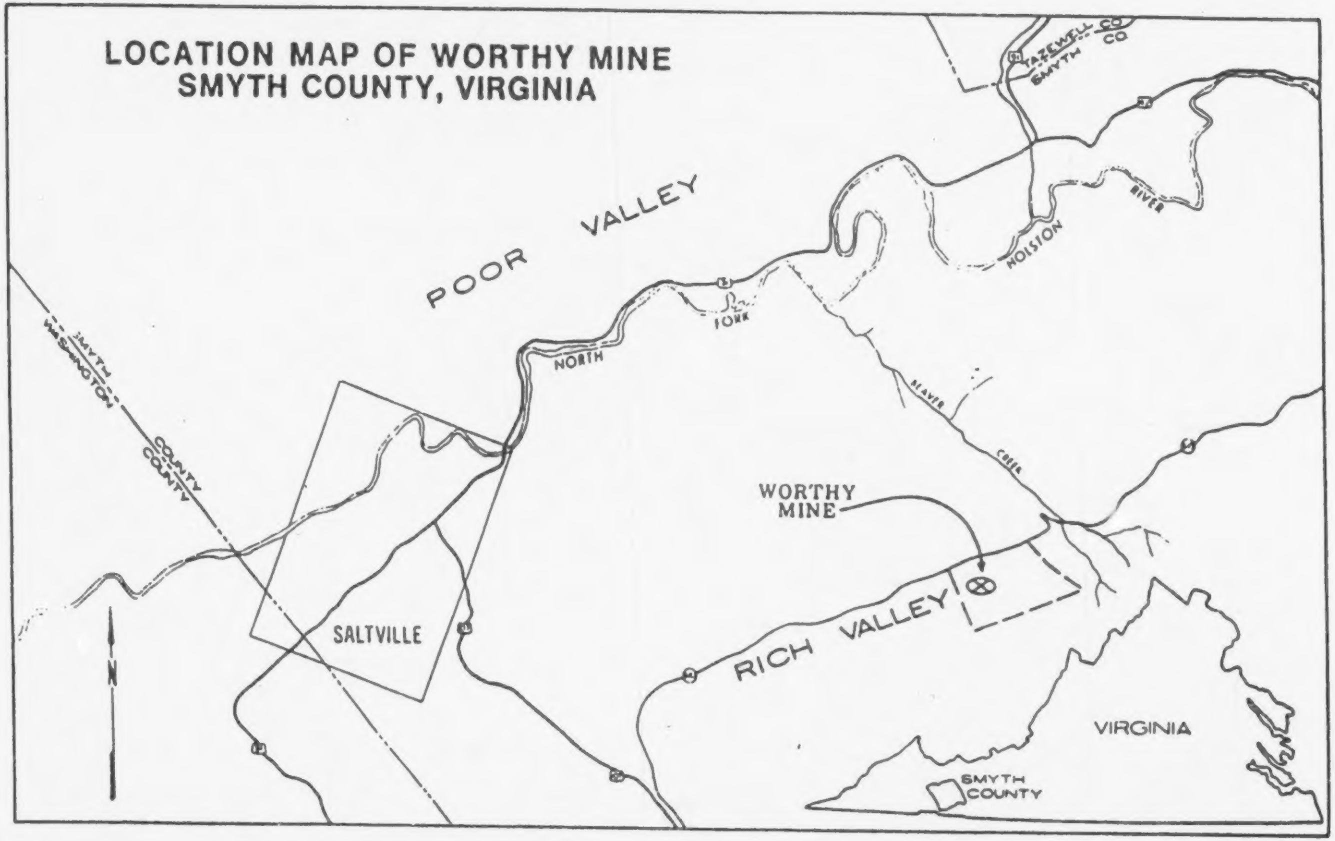
EXPRESSED IN COST PER BARREL

Crude Oil Transportation From Sullom Voe, Shetland Islands, Scotland
to Middle Atlantic U. S. Refineries with Intermediate Storage
at Saltville, Virginia


Crude Movement
By Tanker from Sullom Voe (Scotland) to Norfolk, Va.
Temporary Storage at Norfolk
Rail transport from Norfolk to Saltville
Mine Storage
Rail Transport From Saltville to Norfolk
Barge Rate from Norfolk to Middle Atlantic Refineries
Cost
$3.00/bbl.
+
$.20
+
$1.74
+

+
$1.74
+
$.60
SUBTOTAL
= $7.28/bbl.
Facility Development cost of Worthy Mine
Construction of railhead at Saltville
Rail car rental
Construction of a pipeline between Saltville railhead and Worthy Mine
Cost
$.65
+
$.12
+
$.35
+
$.16
TOTAL
= $8.56

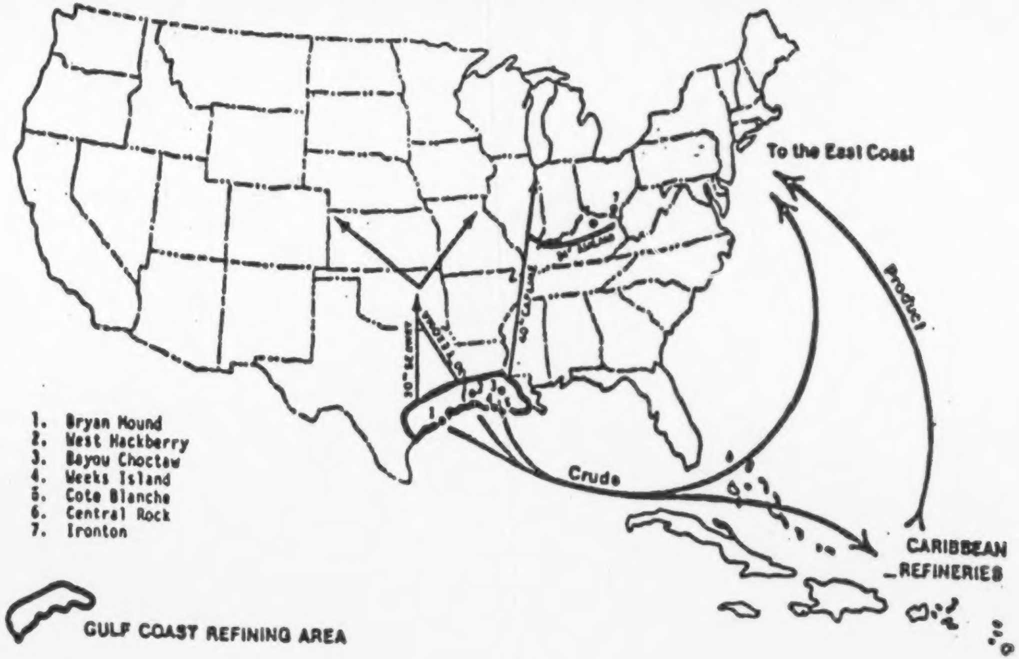
SOURCE: SUSCO and N&W, December 12, 1981.



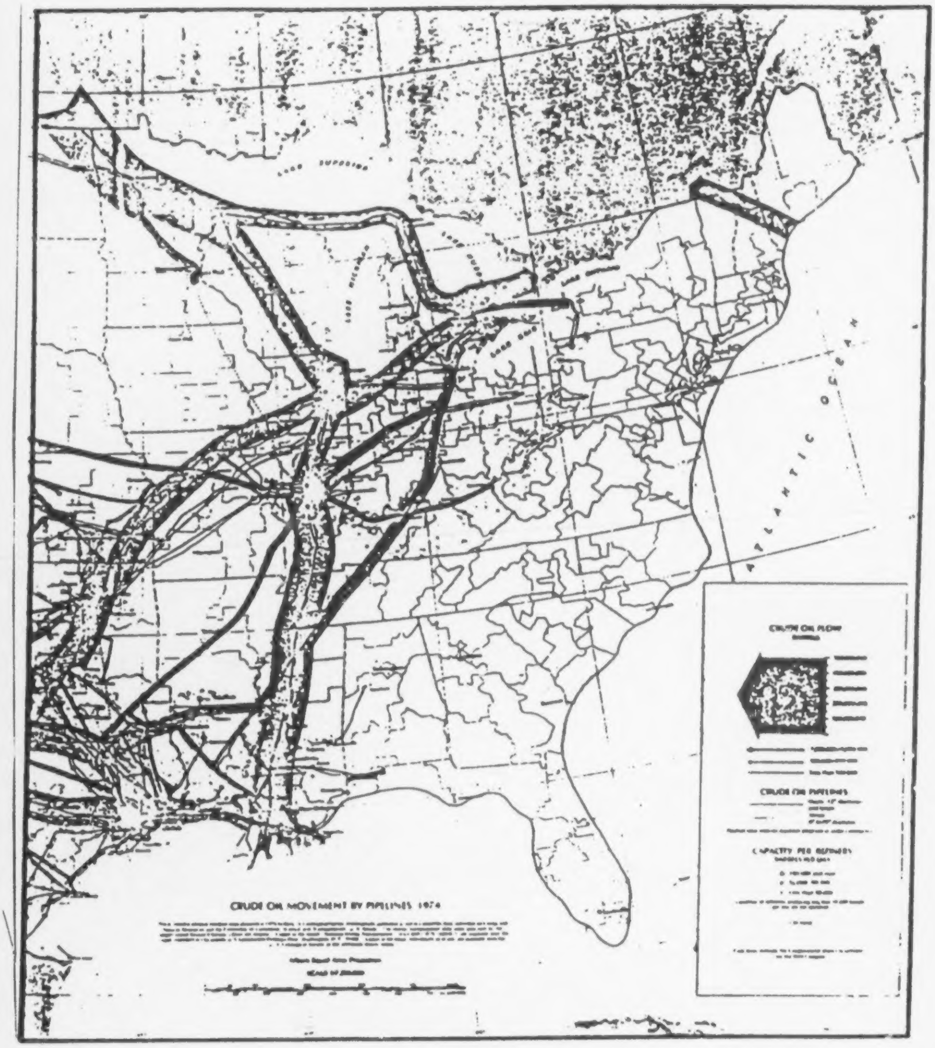
LOCATION MAP OF WORTHY MINE
SMYTH COUNTY, VIRGINIA

TAZEWELL CO
SMYTH CO
POOR VALLEY
HOLSTON RIVER
NORTH FORK
BEAVER CREEK
SMYTH COUNTY
WASHINGTON COUNTY
WORTHY MINE
SALTVILLE
RICH VALLEY
N
VIRGINIA
SMYTH COUNTY

Exhibit 1


To the East Coast
Product
Crude
CARIBBEAN REFINERIES
1. Bryan Mound
2. West Hackberry
3. Bayou Choctaw
4. Weeks Island
5. Cote Blanche
6. Central Rock
7. Ironton
GULF COAST REFINING AREA

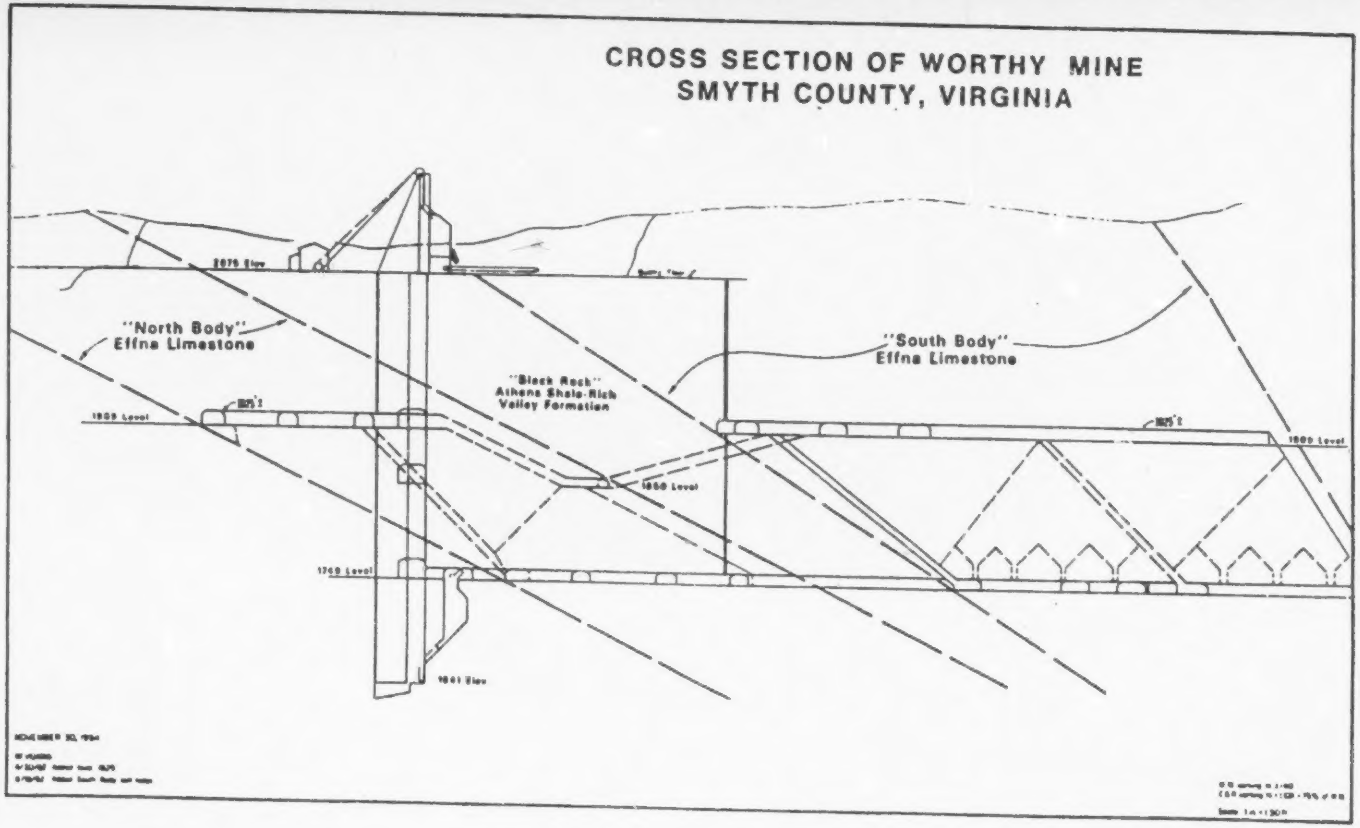
SPR Distribution Network
Exhibit 2


LAKE SUPERIOR
ATLANTIC OCEAN
CRUDE OIL FLOW
CRUDE OIL PIPELINES
CAPACITY PER REFINERY
CRUDE OIL MOVEMENT BY PIPELINES 1974

Crude Oil Movement by Pipeline
Exhibit 3

Exhibit 4
FEA Petroleum Markets
Total USA Refining Capacity
(In Thousands of Barrels Per Day)*

Area Location of Refinery	Refinery Capacity*
Northeast	22
Atlantic	1615
Northern Inland	215
Southern Inland	270
Caribbean	925
St. James	1650
Port Neches	1690
Freeport	2200
Central	4215
Northern	410
Rocky Mountain	385
Inland West	115
Contiguous West Coast	2245
Non-Contiguous West Coast	205
Total	16,162



CROSS SECTION OF WORTHY MINE
SMYTH COUNTY, VIRGINIA

"North Body"
Effna Limestone
"Black Rock"
Athens Shale-Rich
Valley Formation
"South Body"
Effna Limestone
2075 Elev
1900 Level
1850 Level
1760 Level
1641 Elev
1900 Level

EXHIBIT 5

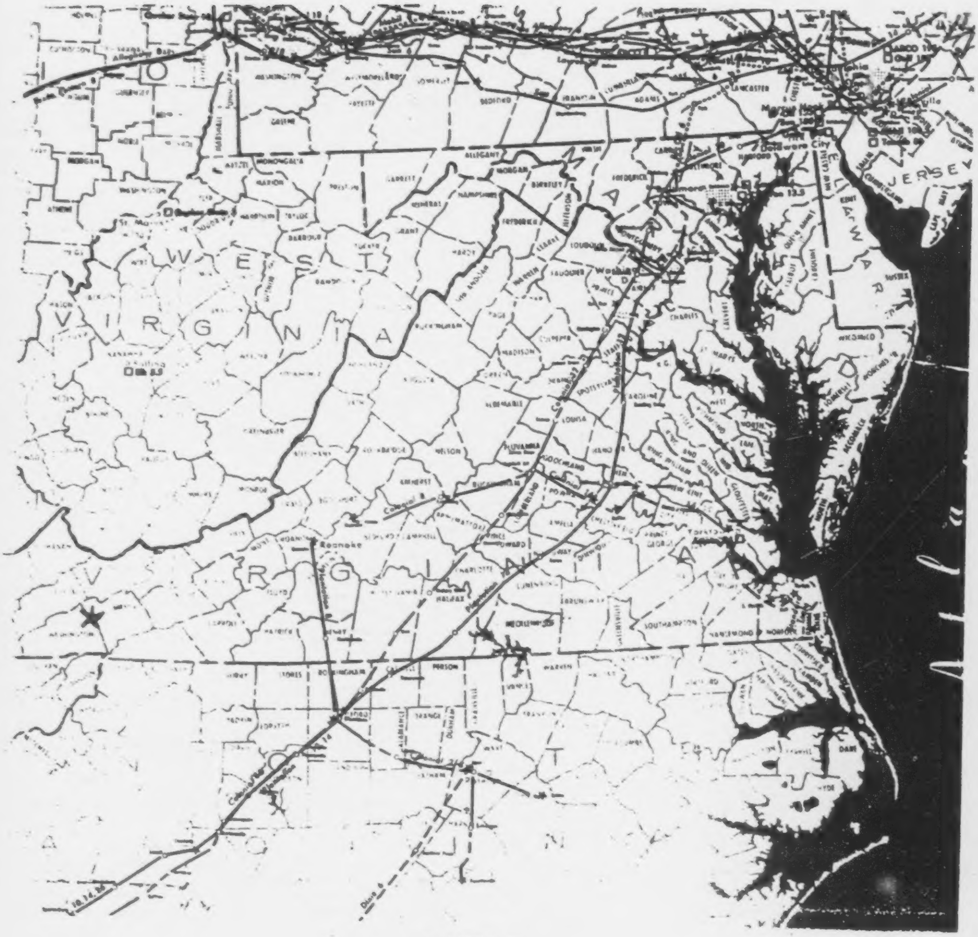
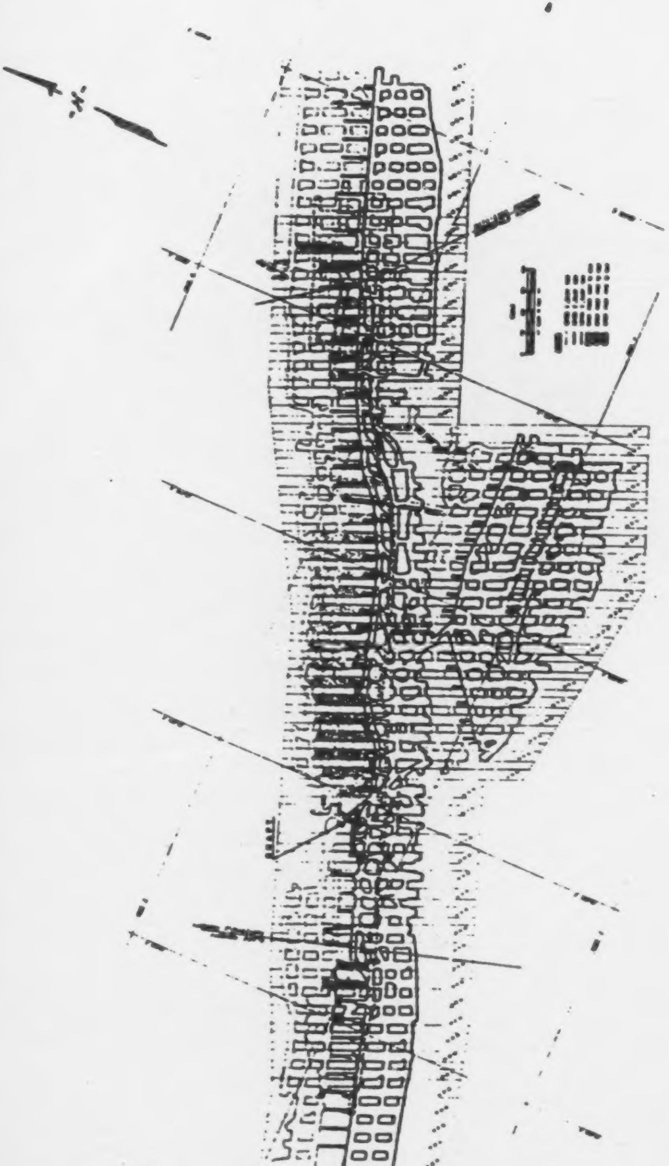

W E S T
V I R G I N I A
V I R G I N I A
M A R Y L A N D
D E L A W A R E
JERSEY
Roanoke
Delaware City
Colonial
Plantation

Exhibit 6

Proximity of Worthy Mine to
Plantation or Colonial Pipelines

Exhibit 7



MINE PLAN
WORTHY MINE
SMYTH COUNTY VIRGINIA

Appendix A

Underground Storage in Finland

Neste Oy's underground oil storage

Stig Johansson
Neste Engineering, Neste Oy
Helsinki

In Finland, the first unlined underground oil storage caverns were constructed in the early 1960s. Such facilities, with a current total volume of more than 10 million cu m (63 million bbl), are now widely used.

There are nearly 75 underground caverns at about 20 different locations. The volume of the biggest unit is somewhat over one million cu m (6.3 million bbl), while the smallest units hold about 50,000 cu m (300,000 bbl) each. Crude oil takes up about 35% of cavern storage capacity; refined products, such as butane, gasoline, diesel oil, and light and heavy fuel oils take up the rest.

In Finland, underground storage facilities have been constructed for the strategic stockpiling of oil and oil products; at oil refineries for bulk storage of feed materials, product components, and final products; and industrial establishments for consumption.

The type of water-bed in a cavern determines the type of product the cavern will hold. Most underground caverns are built on the fixed water-bed system and can store, for example, crude oil, butane, diesel oil, and light fuel oil. Caverns constructed with a fluctuating water-bed have been used for gasoline. Caverns with either a fixed water-bed system or a dry-bottom system are suitable for heavy fuel oils whose temperature must be kept above 50° C.

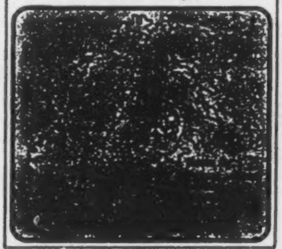
The predominantly Precambrian crystalline bedrock of Finland is excellent for the construction of unlined rock caverns. Such facilities have been constructed mainly in different types of granites, diorites, gneisses, schists, as well as in diabase and rapakivi. The natural ground water table is generally close to the surface—some 55,000 fresh water lakes confirm this fact—thus favoring rather shallow construction depths.

At the moment, all completed installations are working to full satisfaction and there have been no serious accidents or any environmental pollution.

Neste's experience in the storage of oil during the past 15 years has shown that excavated unlined rock caverns offer a more economical solution than do steel tanks on the ground, provided that storage volumes of different oils are large enough.

Fig. 1

Porvoo refinery



Neste's oil storage caverns

Neste, Finland's national oil company, has no oil production of its own. All crude oil is purchased under long-term contracts. In 1980, a total of 11.7 million tons of crude oil was imported, the main sources being:

	1,000 tons	
U.S.S.R.	6,783	(58%)
Saudi Arabia	2,785	(24%)
Iraq	920	(8%)
Iran	658	(5%)
England	568	(5%)

The company's two refineries, at Porvoo and at Naantali, are both located on the southern coast of Finland. The maximum annual output of the Porvoo refinery is 12 million tons, and that of Naantali is 3 million tons.

The crude oil from the U.S.S.R., the Tuizama blend, is piped to Ventspils harbor on the Baltic Sea and transported year 'round to the company's refineries. In winter, transport is by special icebreaking 25,000 dwt tankers.

The Middle East crudes, mainly Arabian and Iranian light and heavy, and Kirkuk and Bashra, must be brought in during the open-water season because the generally severe winter conditions freeze sea lanes and hinder shipping with VLCC-type tankers. For economical reasons Neste's own tankers are about 260,000 dwt, and the tankers are lightened by about 100,000 tons of oil before entering the Baltic Sea.

VLCC-type tankers can navigate in the Baltic only about 8 months of the year. This is one reason why the company must store relatively large amounts of crude oil, i.e., 3 to 4 million tons, for winter use. This crude is stored in unlined rock caverns located in the refinery areas. About 95% of the storage caverns are located at the Porvoo works. They are in intensive use, as they are an essential part of the operational storage space for the 200,000 bbl refined daily.

Depending on the refinery's programs and on the quantities of different imported crudes, the circulation of oil in the various caverns has been from one to six times the total volume of the caverns per year.

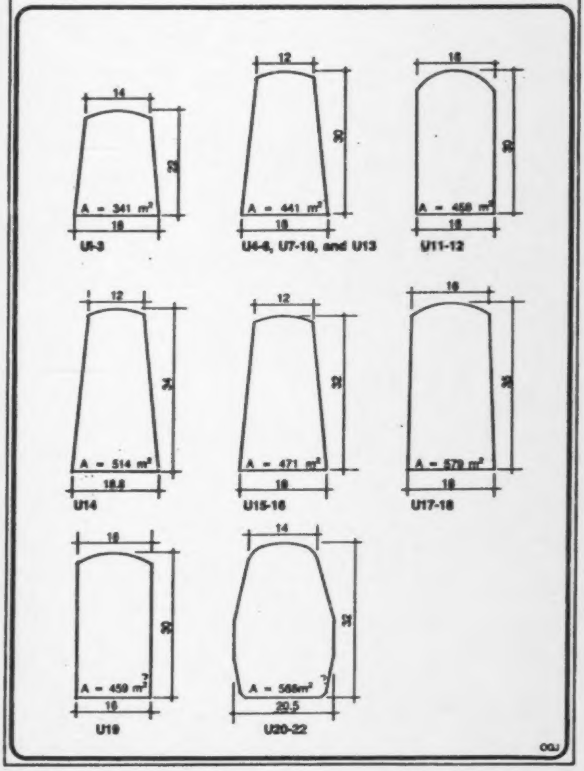
In addition to underground caverns for storing crude oil, the Porvoo works also has five rock caverns for storing oil products.

Cavern history. The first three underground oil storage caverns at the Porvoo works (Fig. 1), named U1, U2, and U3, were constructed during 1965 and 1967. The effective volume of each unit is about 70,000 cu m (440,000 bbl).

The construction of seven additional units, U4, U5/6, U7, U8, U9, and U10, was started in October 1966, and all units were completed by the end of 1968. The total effective volume of the three smaller caverns is 373,000 cu m (2.35 million bbl) and

Fig. 2

Cavern cross sections



of the four larger ones, 677,000 cu m (4.25 million bbl).

These ten caverns are all used for storing crude oil, which means they operate on the fixed water-bed system, and discharge pumping is done with submersible-type pumps.

In the next construction phase, two caverns were completed in 1971 and two in 1972. These four caverns have an effective volume of slightly more than 500,000 cu m (3 million bbl), are operated with submersible pumps, and are used for storing oil products.

In 1972, a 500,000 cu m (3 million bbl) crude oil cavern (U13) was also completed, and in 1975 the crude oil cavern U14, with an effective volume of 550,000 cu m (3.4 million bbl), was ready to start operating.

In March 1974, a contract was signed for the construction of yet another two crude oil caverns (U15 and U16) with effective volumes of 580,000 cu m (3.6 million bbl) and 462,000 cu m (2.9 million bbl), respectively. Both caverns were ready to receive oil in mid-October 1975.

Two additional cavern units for storing light and heavy fuel oils, units U17 and U18, were completed in 1976. Their total effective volume is about 422,000 cu m (2.6 million bbl) and they operate via a so-called dry pump room system. This additional capacity was necessary to achieve an optimum blending of components.

The only cavern, so far, that holds liquified butane has a capacity of 116,000 cu m (730,000 bbl) and was completed in 1976. This cavern operates under a pressure of 3 to 4 bars, and the butane is used mainly in winter as a blending component.

At the beginning of 1981, 19 separate underground oil storage units, with a total effective volume of 4,387,000 cu m (28 million bbl), were in operation at Neste's Porvoo works. The volume of crude oil stored was about 3.34 million cu m (21 million bbl); the volume of petroleum products, 1.04 million cu m (7 million bbl).

In March 1980, construction was started on a new cavern project, (comprising units U20, U21, U22), whose total volume will be 800,000 cu m (5 million bbl). When this project is completed in mid-1982 the total underground cavern space at the Porvoo works will exceed 5 million cu m (30 million bbl), making Neste the largest designer, owner, and operator of excavated unlined caverns in hard rock in the world.

Design aspects. Bedrock structure is studied by means of outcrop mapping, seismic refraction soundings, percussion drillings, and diamond core drillings. The number of core-drilling holes depends on the geologic features of the area. Water pressure tests are carried out to determine the tightness of the fracturing.

In certain cases, the state of stress of the bedrock is measured. No high stresses have been recorded. For rock mechanical calculations, the finite element method (FEM) is used.

One of the most important tasks in the engineering design is to work out a cavern cross-section (profile) that will make it possible to set up a work schedule suited to the mechanics of the bedrock, to the blasting methods and the excavation equipment used, as well as to other cost factors.

The number of individual storage caverns in a project depends on many factors, such as the size and shape of the available rock area, the amount and type of oil to be stored, and the method of storing.

Neste policy is that, in addition to the main access tunnel, at least two, and preferably several, topheadings or overhead tunnels should be under excavation simultaneously. Furthermore, possibilities for maintaining and servicing the equipment must be good at all stages of excavation. At least one vertical shaft is always provided for ventilation during the excavation work, thereby cutting down the hours otherwise lost in ventilating only via the access tunnel.

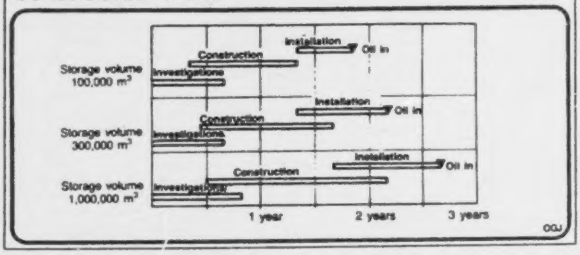
Cavern profiles. The cavern profiles used in the very first underground oil storage project (U1...U3) measured only 338 m². The height of each cavern is 22 m, the width varying between 14 and 18 m.

It soon became apparent, however, that the profile could be considerably enlarged, and in the next phase, (cav-

Cavern with total cross section of 566 m² is ready to receive oil (Fig. 3).

Construction times

Fig. 4



erns U4 through U10), the cavern profile was enlarged to 412 m², the height of each cavern being 30 m and the width varying between 12 and 18 m.

In cavern projects U11 through U19 cross-sections varying between 442 m² and 560 m² were used with no difficulties.

Recent developments in the manufacture of hydraulically operated multiboom jumbo drills have made hydraulic drilling a competitive alternative to pneumatic percussive drilling

With the remarkable technological advances of past ten years in the areas of engineering geology and practical rock mechanics, the engineering design of caverns has entered a new era.

The caverns under construction today (U20...U22) have main profiles of either 566 m² or 585 m²; the shape of the profiles differ considerably from the "conventional" cavern profiles, and the excavation technique is radically different (See Fig. 2).

So far, this new profile has proved both stable and economically competitive. Further advantage lies in the greatly improved work safety it affords, especially in scaling and reinforcements (Fig. 3).

Construction of storage facilities. The strength and intact nature of the migmatite rock (a mix of granite, micagneiss, and pegmatite) in the Porvoo area has meant that construction methods based on drilling and blasting have been the most economical. Only in special cases, such as in shaft construction, is full-face boring considered a favorable alternative.

A few excavation targets in a cavern project are clearly distinguishable. The most important are access tunnels, tunnels and shafts for equipment and piping to the ground surface, and the actual cavern space.

The excavation process is started by blasting out the open cut and the inclined (inclination 1:7 or less) access tunnel leading to the topheading level, the middle levels, and the bottom level of the cavern.

The actual storage caverns are usually excavated by using the tunnel-benching or stopping method in which the upper part of the cavern or the topheading is excavated first. Work is then started on the lower part, which will consist of one, two, or even three benches, by either horizontal or verticle drilling, or a combination of the two.

The excavation process is always planned so that the different stages in the work not only balance one another but are also in balance relative to labor and equipment, for overall cost effectiveness. Disruptions are reduced and total output is increased when a number of simultaneous and alternative work targets are available.

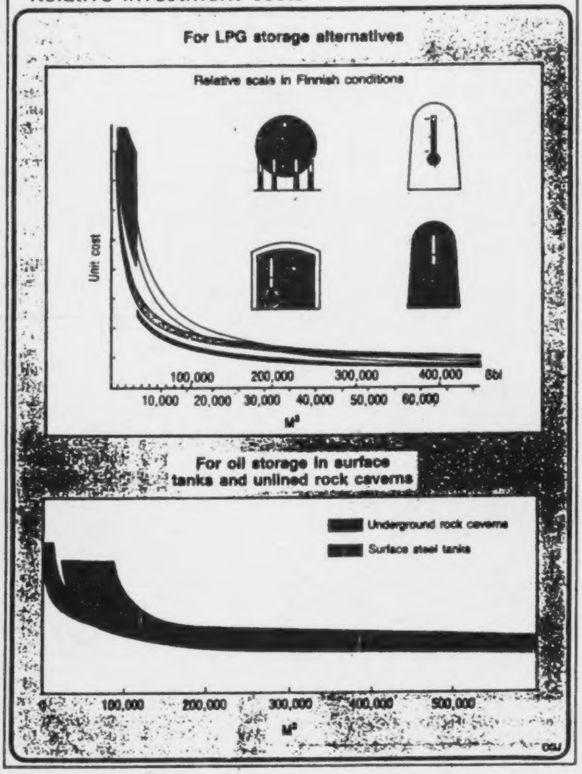
The excavation, particularly of the arches, is carried out by cautious blasting and smooth-blasting methods which ensure high quality excavation and minimize costs for scaling and extra reinforcements.

In the overhead tunnel of a cavern, 400-500 m³ of rock can be excavated in one 8-hour shift.

At the benching stage, the bottleneck of the excavation process is no longer drilling and blasting, but re-

Fig. 5

Relative investment costs



moving the broken rock.

An average excavation capacity of between 2,000 and 3,000 m^3/day is well within reach. A peak daily capacity of 7,200 m^3 and the best average monthly capacity of 5,600 m^3/day are record achievements at the Porvoo works. These figures are neither appropriate nor recommended as design targets.

When reinforcements are needed, the most commonly used methods are bolting and shotcrete lining. In some cases only spot bolting, together with partial shotcrete lining, has been needed. In some caverns the roofs and the walls are virtually unreinforced.

Contract forms and time schedules. The smooth progress of the excavation process calls for carefully prepared design documents. Long experience in design and excavation will help to solve many problems related to these documents.

Two types of contracts are used in the company's cavern projects. One works on the turn-key principle; the other is the so-called divided contract.

In the latter, rock removal and concrete work are undertaken by one contractor, and the technical construction and installation work by other specialized contractors.

In both cases, all design work as well as all work supervision and testing is carried out by Neste.

In the construction of a cavern project in which storage volume has been between 200,000 and 500,000 m^3, the total period of excavation and reinforcement has varied from 12 to 18 months. The total construction period can be shortened considerably by having excavation, construction, and installation operations overlap (Fig. 4).

Costs

A study of average investment costs, expressed as a percentage of total costs for underground storage projects in Finland yielded the data in Table 1. Major factors affecting total costs, as well as the unit cost per effective oil volume, are:

- The quality of the bedrock and ground-water conditions
- The size and dimensions of storage caverns
- The number of storage units and the total volume of the plant
- The type of oil to be stored and the method for storing
- The amount of reinforcing and grouting needed
- Types of unloading and loading facilities
- Design loads on concrete structures
- Types of installations and degree of automatic and remote control
- Requirements for purification of leakage water and need for replacement of ground-water.

The use of excavated rock has also had an effect on lowering total costs. Rock waste can be used for such purposes as aggregates, for the construction of roads, railways, and breakwaters, as well as in the levelling of above-ground areas.

Relative investment costs for the storage of oil in surface steel tanks and/or in unlined rock caverns at Neste are presented in Fig. 5.

From these graphs it can be seen that the price of a rock cavern increases very slowly in relation to volume, hence favoring the storage of large quantities of oil.

In Neste's experience, a rock cavern of 150,000 m^3 (0.9 million bbl) or more has been cheaper to build than steel tanks under all market conditions. This applies to any type of oil stored so far. For LPG the corresponding cavern volume is considerably smaller.

Exact cost figures have been deliberately left out of the graphs. However, the unit costs of the storage caverns constructed during the 1970s have varied from US $20 to $40 per effective cu m of cavern volume.

Operation and maintenance costs. At Neste's refinery in Porvoo there are over 100 steel tanks in the tank farm, with a total volume of about 1.6 million m^3. At the same location are 19 operating underground caverns with a total volume of 4.3 million m^3. The combined operating and maintenance cost for the above-ground tank farm has been US $1.80 per m^3 per year and for underground caverns US

The author...

Johansson

Stig Johansson is an engineering geologist at Neste Engineering, a division of Neste Oy. For 15 years he has been involved in the site investigation and predesign of underground structures in hard rock, such as tunnels and oil storage caverns, both in his home country and abroad. He has particularly been concerned in practical rock mechanics and excavation techniques and has acted as main designer of rock reinforcements. During the past two years, he has also carried out a number of engineering geological prefeasibility studies for oil storage caverns in a number of foreign countries. Johansson graduated from the University of Helsinki in 1964 as M.Sc. and in 1966 as Lic.Phil. with majors in geology, geophysics, and hydrogeology.

\$0.30 per m^3 per year.

The maintenance of equipment in underground caverns is somewhat complicated. For example, some equipment can be removed only when the cavern is depressurized, which may result in some product losses. Thee is also a risk or corrosion in the underground environment. Equipment in such an environment must therefore be made of materials that will withstand corrosion for the 20 to 50-year lifetime of the cavern.

The need for repair of the cavern itself or of its concrete structures is not likely during the cavern's lifetime. However, the company has successfully repaired crude oil as well as heavy fuel oil caverns, simply by going inside the caverns.

Ground-water control. Variations in the level of the natural ground-water table are checked weekly by observations at the ground-water wells at some 70 locations in the refinery area. These observations were started in 1970.

No serious draw-downs have occurred. The water table is rather stable in the areas where the caverns are located, and any variations correlated closely with annual variations in precipitation. In all cases, the ground-water flow is towards the caverns.

The flow of water into the caverns is also checked and measured daily and weekly. The amount of water leakage varies between 1 m^3 and 20 m^3/day per each 100,000 m^3 of cavern volume. These amounts are rather small and hence the treatment and purification of leakage water is both cheap and easy to handle.

Summary. The main benefits of storing crude oil and various petroleum products in unlined rock caverns at Neste's refineries can be summarized as follows:

- Investment costs are lower, provided that the storage volume exceeds a certain minimum.
- The risk of fires and explosions is minimized, and possible damage can be limited with a proper design.
- High pumping rates, up to 15,000 m^3/hour with no hydrocarbon emissions into the air, can be used when unloading tankers, thereby reducing expensive harbor time.
- Large amounts of crude oil can be stored separately and under a pressure of up to 2.5 bar absolute, thus reducing evaporation losses.
- Insurance costs are reduced.
- Operating and maintenance costs are only about one-sixth of the corresponding costs for surface tanks.
- Above-ground space can be used for other purposes.
- The relatively low heat conductivity of rock reduces heating costs for heavy fuel oils.
- Conventional transfer pumps installed in a dry pump room close to the bottom level of a cavern enable large volumes to be pumped out, and the same pumps can be used to serve several cavern units.

It should also be noted that the close cooperation between the engineering and maintenance departments of the refinery ensures that the design of caverns is fully satisfactory.

At Neste, the present total cavern volume is about 5 million m^3; an additional 10 million m^3 of underground cavern space can be constructed within the company's property limits at the Porvoo works. The future will tell.

Acknowledgments

I would like to thank Neste Oy, and particularly the director of Neste Engineering, assistant vice-president Yrjö Ignatius, for permission to publish this article. Chief design engineer Esko Koskinen kindly read the manuscript and made many useful remarks, for which I express my thanks.

Bibliography

Koskinen, E., Kangas-Ikkala, R., Underground oil reservoirs of the Neste Oy's Porvoo plant, Finnish Building Magazine No. 4 pp. 172-177, 1968
Johansson, S., Lahtinen, R., Oil storage in rock caverns in Finland, Tunnelling-76 paper No. 13, 1976
Johansson, S., Lahtinen, R., Oil storage caverns in Finland, Tunnels & Tunnelling, September 1976, pp. 29-32, 1976
Koskinen, E., Johansson, S., Oil storage caverns, Finnish Trade Review No. 1, 1979.
Ignatius, Y., Underground storage of oil and gas products, Subsurface Space, Volume 1, pp. 53-57, 1980.
Johnansson, S., Geological surveys for underground oil storage facilities, Underground Space, Volume 5, pp. 36-39, 1980
Atlas Copco on-the-job report "Underground oil storage at Neste Oy, Porvoo works in Finland," MCT Printed Matter No. 15781, 1981

Senator WARNER. We now have John Buckley of the Independent Fuel Terminal Operators Association. It is nice to see you again.

STATEMENT OF JOHN G. BUCKLEY, INDEPENDENT FUEL TERMINAL OPERATORS ASSOCIATION, WASHINGTON, D.C., ACCOMPANIED BY LEONARD P. STEUART II, PRESIDENT, INDEPENDENT FUEL TERMINAL OPERATORS ASSOCIATION

Mr. BUCKLEY. Thank you, Mr. Chairman. It is nice to be here and I appreciate having the chance to comment and I wish to commend this committee for holding the hearings on this particular subject, which I believe in view of the action yesterday in upholding the President's veto, that this subject is extremely important for the country and the region of the country that I am from.

I would like to talk a little bit about facts today, not economic philosophy. The Government has in fact told us that we must now trust the market, that the Government is not going to take care of us no matter what the problems are; we are going to take care of ourselves.

There will be no bailouts and so we trust the market. But what does the market tell us today? The market tells us today that we have to minimize stocks, the cost of holding intrastocks is about $8 per barrel per year, mostly because of interest costs. If we want to stay in business at all, we have to run leaner than we ever have before, whether we are a refiner or a market.

If we trust the market and the market has told consumers be sure the price mechanism to use less oil and in fact consumers are using a lot less oil than even 2 years ago. In a crisis if we trust the market and the price goes up high, demand will drop. There will be some extra supply and if all of our energy sources in this country were free, readily substitutable, and free of controls, it might work. But in fact coal only substitutes for oil in limited ways and in the short range a very limited degree.

Gas will not substitute for oil, because it is under price controls and if oil prices double gas prices stay just where they are. There will be no gas conservation or there will be no additional gas supplies. We are basically looking just at the oil situation.

The administration seemed eager to trust the market, eager enough to veto all standby powers. Apparently, however, they did not have the courage to press for gas decontrols. It does not trust the market that much. So we are left with oil. Gas will not help and coal can only help in a limited way.

There is very little fat left in the oil future. A year and a half ago when we finished our National Petroleum Council study of emergency situations and concluded that we did need standby authority in the event there were shortages, approaching 2.5 million barrels a day. Since that time with the demand down, oil conservation, there is very little fat left. I would have to guess if there is somewhere around maybe a quarter-to-a-million-and-a-half-barrel-a-day shortage, we would be in trouble. We would have physical runouts, physical shortages, and enormous political and economic consequences.

So I call on you, Mr. Chairman, and this committee to break some new ground. This committee, as you are perhaps aware, back after the first embargo, the first shock, worked to develop a strategic storage program. The administration at that time did not want one. This committee in effect was the pioneers and their work led to the development of the Nation's first strategic storage program.

Now, there is a lot of spare storage capacity out there on the east coast and elsewhere in the country that we need to use. We need to use it for crude oil. We have one-sixth counting Buffalo 1.8 million barrels a day of east coast capacity. That is 85 percent on the foreign crude. We need to use it for heating oil in case the crisis comes in the middle of winter, like the last two times. And we need to use it for residual fuel, because we import so much of that product.

At least we need to do it on an interim basis, 3 to 5 years, until the salt dome capacity is capable of handling the fill rate that Congress wants it to use, 300,000 barrels a day.

Our group, which represents some 56 separate terminals and has over 55 million barrels of storage certainly pledged to work with this committee and the staff and with the DOE so that we use storage on an interim basis widely, wisely, and at competitively low cost.

Mr. Chairman, I have been in this business 28 years and in the recent weeks the decision not to decontrol gas and the decision to veto emergency preparedness standby plans have left me feeling rather frightened. I have negotiated crude contracts around the world and the Middle East and Africa, South America. I have negotiated freight arrangements. Nationally and internationally I have been involved on the financial side and the overall management side.

And as I look out there this week and see Libya calling for the overthrow of Saudi Arabia and see Iran and Iraq speeding up and accelerating an already bloody and costly war and see the Israelis coming out on the West Bank and the Arab Palestinian terrorists coming back inside of Israel again, it is a bit frightening.

Sure, it is understandable why the man on the street is complacent. Prices are going down. There is a so-called glut, but that can turn around so rapidly.

I have a feeling that strategic storage is not the Nation's first line of defense, nor is it the last line of defense. It is the only line of defense. And I am hopeful that this committee will show the DOE how to break new ground and to insist that it does.

We would certainly like to see, particularly on the east coast, and the 100 million people who live there and the very limited refining capacity we have and the total need to import some 6 million barrels a day of total use into our area, regional storage in our area. I certainly understand the need to look at southern Hawaii and possibly in other remote areas of the country that are served by only a few refiners with no access as we have to foreign supplies.

I would be very pleased, I have submitted a full statement for the record, and I would be very pleased to answer any questions that you might have.

[The prepared statement of Mr. Buckley follows:]

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STATEMENT
# of the
INDEPENDENT FUEL TERMINAL OPERATORS ASSOCIATION
on
ALTERNATIVE STORAGE PROPOSALS FOR THE STRATEGIC PETROLEUM RESERVE

before the

SUBCOMMITTEE ON ENERGY AND MINERAL RESOURCES
COMMITTEE ON ENERGY AND NATURAL RESOURCES
UNITED STATES SENATE

Washington, D.C.

March 25, 1982

Mr. Chairman:

The Independent Fuel Terminal Operators Association ("IFTOA") welcomes this opportunity to present a proposal to increase the fill-rate and increase the efficiency of the Strategic Petroleum Reserve ("SPR"). IFTOA is composed of 16 companies which operate deepwater oil terminals along the East Coast from Maine to Florida.*/ None is affiliated with a major oil company. Members are primarily marketers of residual fuel oils (Nos. 4, 5 and 6 fuels) and home heating oil (No. 2 fuel); several companies also market significant volumes of gasoline at wholesale and retail levels. Members handle nearly 50% of the non-utility residual fuel oil shipped to the East Coast, nearly 60% of the non-utility residual fuel oil shipped to New England, 25% of the No. 2 heating oil shipped to the East Coast, and nearly 50% of the No. 2 heating oil shipped to New England.

Our members operate 56 deepwater terminals and 40 barge terminals with a total storage capacity of over 57 million barrels. The geographic distribution of those facilities is as follows:

	No. of Terminal Operators	No. of Terminals		Total Storage Capacity **/
		Deepwater	Barge	
New England	6	22	6	14,955,971
Middle Atlantic (New York-Maryland)	7	14	24	29,284,833
South Atlantic	3	20	10	13,206,502
Totals:	16	56	40	57,447,306

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*/ A list of members and description of the Association is attached. (Attachment A).

**/ The product breakdown is as follows:

No. 2 fuel oil	26	million barrels
Residual fuel	24	million barrels
Gasoline and other products	7.4	million barrels.

In order that the Subcommittee may best evaluate our proposal to enhance the SPR, we would like to provide a brief description of our operations. Most of our members have been in the terminal business for generations. Some companies began in the ice business, moved into the coal business, and then became fuel oil marketers as that energy source became dominant in our marketing areas. We operate, as you can see from the chart above, a number of large terminals which are capable of receiving ocean-going tankers. As the Subcommittee knows, the typical terminal facility consists of docks, unloading facilities, pipelines, storage tanks, and "racks," the platform from which oil is pumped from the tanks into fuel oil trucks for transport to the consumer. Our terminals are located in or near the areas of consumption of fuel oil and are an integral part of the complex distribution system that carries bulk petroleum fuels from the refinery to the ultimate consumer.

I. Status of Reserve

A. Energy Security

At the outset, we wish to commend the Chairman and this Subcommittee for its concern about the status of the Strategic Petroleum Reserve. IFTOA has, since its formation in 1968, been a strong supporter of the Reserve. As we stated in testimony before the Congress in 1975 in support of the first major proposal to establish a reserve:

> In establishing priorities for consideration of the various energy proposals before it, the Congress should assign first place to

> this legislation. There is no better cost-effective way to remove the threat of an embargo than to have a 3-6 month reserve to draw on in case of a supply interruption. */

We share the concerns of the Congress, this Subcommittee and the General Accounting Office that the mandated objectives are not being met and that the fill-rate for the Reserve is lagging badly. In addition, we have become increasingly concerned about the ability of the SPR, as presently conceived and located, to deal effectively and efficiently with a supply disruption.

B. Location of the Reserve

1. Need for Dispersed Storage

At present, the Reserve is located at only a few underground sites concentrated on the Gulf Coast. Despite this fact, the Department of Energy ("DOE") planners assume that during a shortage they will be able to move crude oil and refined products quickly and efficiently to the consuming centers of the United States. However, in light of the currently inadequate drawdown plan, this assumption does not appear to be supportable. While we agree that the major volumes in the Reserve should be placed near the nation's primary refining center, the Gulf Coast, we strongly believe that portions should also be placed near the consuming centers. In this way the Reserve will be more strategically

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*/ Statement of John G. Buckley on behalf of the Independent Fuel Terminal Operators Association on the Strategic Energy Reserve Act (S. 677 and S. 594) before the Senate Committee on Interior and Insular Affairs, Washington, D.C. (April 7, 1975).

placed; such dispersal will add an additional element of security from accident or sabotage and will ensure that market forces can deal most effectively with the crisis.

2. East Coast Storage

As this Subcommittee is aware, the East Coast consumes more than one-third of the nation's oil.[*/] In addition, the 1.7 million b/d of refining capacity located along the East Coast (concentrated most heavily in the New Jersey-Pennsylvania area) is 85% dependent upon imported crude oil; in contrast, the Gulf Coast and the nation as a whole are only 39% dependent.

Unfortunately, the SPR is not, at present, designed to deal effectively with the problems of the East Coast and, in particular, the Northeast. Those areas remain vulnerable, in case of an embargo, to the threat of shortage, and perhaps most seriously, to the threat of sharply increasing prices.

A basic defect of the Reserve is its failure to place crude oil close to the East Coast refineries and to place refined products close to the East Coast markets. As indicated, because of their heavy dependence on imported crude oil and products, those plants and those markets will feel the effects of a supply interruption almost immediately. Whether there will be actual shortages depends, of course, on the severity of the reduction in foreign supplies; given

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[*/] See generally State Energy Data Report, Department of Energy, September 1981.

the current reduced level of demand in the U.S., the threat of run-outs seems to us far less than in 1973. But it is still there, and, with the SPR crude oil now concentrated in a few locations on the Gulf Coast, an accident at a storage site, a shipping accident, or other delay could easily create chaos and shortage in the Northeast.

In addition, there is growing concern that the underground salt caverns will become useless after crude oil has been deposited and withdrawn only a few times -- perhaps two to five; no one is, of course, certain. Thus, in the early months of a shortage, before the severity and length becomes clear, DOE might be hesitant to withdraw oil and thereby use one of these valuable cycles. Withdrawal from above-ground tankage would, of course, avoid this problem. Crude oil and products stored in steel tanks could be used in the early period of any disruption, thereby leaving the oil stored in salt domes for use at a later date.

II. SPR Impact on Spot Prices

A. Relation of Spot Prices to OPEC Increases

Despite the increase in SPR volumes, our nation remains very vulnerable to the threat of sharp increases in the price of crude oil and product. In order to understand the nature of this threat, it may be useful to recall the actual sequence of events in 1973-74 and 1979, which enabled the OPEC nations to jump the price of crude oil by 500% in 1973-74 and by 250% in 1979. The leverage -- and excuse --

seized upon by the oil-supplying nations to make these moves was not, in actual fact, the apparent shortages being experienced in some consuming nations, but rather the sharp increase in the spot prices of crude oil and product. The critical fact is that those spot moves preceded the contract price increases. When the Arab Oil Embargo began in October 1973, the spot and contract prices for crude oil were essentially equal. During the last quarter of 1973 and through 1974 the relationship was as follows:*/

		Spot Price ($/bbl)	Official Price ($/bbl)
1973			
	4th Qtr.	4.10	3.65
1974			
	1st Qtr.	13.00	8.65
	2nd Qtr.	10.60	9.60
	3rd Qtr.	10.00	9.60
	4th Qtr.	10.30	10.40

When the Iranian crisis began in the fall of 1978, the spot and contract prices were also essentially equal. During the last quarter of 1978 and throughout 1979 and 1980, the relationship was as follows:*/

		Spot Price ($/bbl)	Official Price ($/bbl)
1978			
	4th Qtr.	13.50	12.70

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*/ Petroleum Intelligence Weekly, Vol. XXIX, No. 42 (October 20, 1980) at 11. Prices of products also rose in response to market fears and spot crude oil price increases.

	Spot Price ($/bbl)	Official Price ($/bbl)
1979		
1st Qtr.	18.35	13.48
2nd Qtr.	27.35	16.15
3rd Qtr.	32.90	18.89
4th Qtr.	38.17	22.84
1980		
1st Qtr.	36.58	27.17
2nd Qtr.	35.52	28.82
3rd Qtr.	33.30	30.21
4th Qtr.	38.63	31.33

In summary, during the two oil crises of the past decade, the spot price moved first and pulled the official contract price upward. Once they had reached these high levels, the official contract prices remained there long after the shortage had passed. Thus, the United States continued to pay for the disruption, long after it ended.

Clearly, it is in our national interest, and a major objective of the SPR program,[*/] to avoid such price jolts. Fortunately, past history offers clear guidance on how to do so: we must first prevent a recurrence of the sharp jump in the spot markets which occurred after the Oil Embargo was announced in October 1973 and after the Shah of Iran fell in December 1978.

B. Relation of Market Perception to Spot Prices

As this Subcommittee knows, the spot market responds to perceptions and fears. In the two major crises of the

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[*/] See Section 151 of the Energy Policy Conservation Act, 42 U.S.C. §6231.

1970's, people believed that oil was running short (after all there was a "cut-off") and were afraid that they could not get enough; hence, people plunged into the spot market to buy whatever they could -- and the price shot up. Ironically, it has been demonstrated that the reductions in available foreign imports -- and hence the resulting "shortage" -- were far less severe than feared at the time.[*] In fact, import and demand levels today are very similar to those during the Embargo[**] and yet we now have a "glut" and falling prices -- a clear example of the impact of fears and perceptions on the marketplace.

As we have seen, the most lasting and severe damage caused by the Embargo was the result of panic in the spot market, which gave OPEC members an excuse to move crude oil contract prices up sharply and then maintain them at highly

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[*] Lane, William C., Jr., "The Mandatory Petroleum Price and Allocation Regulations: A History and Analysis"; Report to the American Petroleum Institute (May 1981), Chapters II and III.

[**] Imports as a Share of Total Petroleum Demand

	Imports	Demand	Import Share
	(MMB/D)	(MMB/D)	(%)
4th Qtr. 1973 [1]	6.4	17.6	36.5
1st Qtr. 1974 [1]	5.3	16.9	31.2
4th Qtr. 1981 [2]	5.4	15.9	34.2

[1] "Crude Petroleum, Petroleum Products and Natural Gas Liquids," U.S. Department of the Interior, Bureau of Mines (December 1973 and March 1974);

[2] API Monthly Statistical Report, Vol. 5, No. 12 (December 1981).

inflated plateaus. Accordingly, if the SPR is to do the most effective job, it must deal with the fears and perceptions of oil purchasers.

As companies who have operated in the oil markets for many decades, we strongly recommend that crude oil storage be placed in key areas of the nation, particularly near the refineries of the Northeast. In addition, we strongly recommend that product storage, particularly for heating and industrial fuels, also be located in or near the areas of highest consumption. Such steps will provide both physical and psychological assurance to refiners, marketers, and consumers in those regions. It will remove the fears that often fuel the spot market; it will enable the Federal government to move actual volumes, "wet barrels," into the distribution system, from the refinery through to the factories and homes in the most vulnerable regions of our nation. In short, the SPR must deal with the fact that 10% of the nation's refineries and about 35% of our oil consumption is along the East Coast. Thus, if SPR oil is placed near those refineries and consumers, it can prevent a repeat of the sharp spot market jumps of the past -- a major objective of the SPR plan.

The Administration and the Congress have jointly concluded that allocation and price controls should, if at all possible, not be used to deal with a supply disruption.[*/] Bitter experience has shown that controls only make the disruption worse.[**/] Experience has also shown that the resistance to controls easily crumbles under the political pressures created when a perceived shortage is accompanied by a sharp increase in prices; a sharp price jump creates an irresistible demand for Government action. Thus, the "market calming" effect of the East Coast reserve during a crisis can also play a major role in reducing the pressures for price and allocation controls.[***/]

III. Maintenance of Accelerated Fill-Rate

Placement of large volumes of crude oil and products along the East Coast will also deal with the most immediate problem facing the SPR: the slow fill-rate. Because of the drop in U.S. petroleum consumption, a substantial surplus in

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[*/] S. Rep. No. 97-199, 97th Cong., 2nd Sess., to accompany S. 1503, "Standby Petroleum Allocation Act of 1981" (October 1, 1981); H.R. Rep. No. 97-363, 97th Cong., 2nd Sess., to accompany H.R. 4700, "Standby Petroleum Emergency Authority Act of 1981" (December 7, 1981).

[**/] Kalt, Joseph P., Economics and Politics of Oil Price Regulation, MIT Press, Cambridge, Massachusetts (July, 1981).

[***/] IFTOA wishes to make clear that it agrees with the recent position of the Senate-House Conference on S. 1503, the "Standby Petroleum Allocation Act of 1982," that "the use of SPR oil for nonstrategic purposes, such as a source of revenue or as a market normalizing mechanism in the absence of a crisis, is an issue of grave concern . . . ." Statement of Managers, February 17, 1982, at 12. (emphasis added).

above-ground storage capacity is now appearing. We thus have an excellent opportunity to take advantage of two fortuitous events -- the surplus capacity and the continuing drop in world crude oil and product prices -- to make major additions to the strategic reserve.

In a report released in December 1981,*/ the General Accounting Office made the following recommendation to the DOE:

> Evaluate options for achieving an average annual fill rate of 300,000 barrels per day . . . . The evaluation, which should be available for fiscal year 1983 congressional budget deliberations, should assess costs and benefits of alternatives to constructing new underground storage facilities, including such options as leasing temporary storage capacity. (Emphasis added.)

The members of our Association are prepared to offer a substantial volume of storage, on long-term lease, to the SPR. A preliminary survey indicates that IFTOA members alone can make more than 12 million barrels of storage capacity available. Several entire terminals are available for lease to or purchase by the Government. Much of the storage is currently suitable for No. 2, No. 4 or No. 6 oil; some of it is suitable for crude oil. With a small investment, conversion of the product storage tanks to crude oil usage could be effected very quickly. All the terminals are located on waterways and could receive tanker shipments of oil. The nearby refineries could, of course, be supplied by barge or tanker, and in some cases, pipeline. The terminals are well maintained, meet all safety and environmental regulations, and are generally in excellent condition.

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*/ "Strategic Petroleum Reserve: Substantial Progress Made, But Capacity and Oil Quality Concerns Remain," Report to the Congress by the Comptroller General of the United States, EMD-82-19 (December 31, 1981).

We are ready to work with the Department of Energy to do whatever is necessary to make these facilities promptly available for the Strategic Petroleum Reserve. Negotiations as to volumes, costs, and specific terms must, of course, be conducted by the individual companies; however, we, as an Association, are prepared to provide appropriate guidance and support to this Subcommittee and to the Department of Energy to ensure the most effective implementation of this proposal. While each individual member will present its own cost estimates, we are confident that they will be competitive with, and in some cases less than the cost of preparing and using salt domes.

IV. Recommendation

In order to ensure that the Congressionally-mandated fill-rate is achieved and in order to avoid the sharp price spirals that occurred during past supply crises, the Independent Fuel Terminal Operators Association recommends:

(1) The placement of 10% of the total SPR volume along the U.S. East Coast;

(2) The use of existing above-ground steel tanks for storage of crude oil or petroleum products; and

(3) The leasing, on a long-term basis, of such tanks, with the facilities to be operated by the terminal owner; or the sale of entire storage terminals to the U.S. Government.

We are in the process of preparing for the DOE and the Congress a more detailed plan for implementation of these recommendations.

Some questions have been raised about DOE's authority to use above-ground tanks as a means of complying with the 300,000 barrels per day fill-rate for the SPR. Our counsel has researched this question and concluded that DOE has sufficient authority to take such action. Counsel has also concluded that it would be helpful if this Subcommittee made clear, in a report to the Senate,[*] that use of above-ground storage is consistent with the SPR plan and with achievement of the mandated fill-rate; and that no additional Congressional review is required for use of such storage.

V. Conclusion

We wish to commend the Chairman and this Subcommittee for their concern about the current status of the SPR. We share that concern and are particularly disturbed about (a) the failure to achieve the Congressionally-mandated fill-rate; (b) the related failure to take full advantage of the declining costs of crude oil and refined products in today's market; and (c) the failure to insulate the East Coast and the U.S. market from the devastating effects of a sharp rise in crude oil and product prices in a supply disruption.

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[*] We are drafting proposed report language for submission to the Subcommittee in the near future.

We strongly believe that the proposal presented to this Subcommittee, for the prompt use of surplus aboveground storage tanks along the East Coast, can make a major contribution toward correcting the defects in the current SPR plan. We agree with this Subcommittee that the SPR is our first line of defense in dealing with a future supply emergency, and pledge our assistance in your efforts to improve the efficiency and effectiveness of the Strategic Petroleum Reserve.

Thank you very much.

ATTACHMENT A

MEMBERS

INDEPENDENT FUEL TERMINAL OPERATORS ASSOCIATION

Astroline Corporation
Saugus, Massachusetts

Belcher Oil Company
Miami, Florida

Bray Terminals, Inc.
Albany, New York

Colonial Oil Industries, Inc.
Savannah, Georgia

Eastern Seaboard Petroleum Co., Inc.
Jacksonville, Florida

Meenan Oil Co., Inc.
New York, New York

Northest Petroleum Industries, Inc.
Chelsea, Massachusetts

Northville Industries Corp.
Melville, New York

Pittston Petroleum, Inc.
Montvale, New Jersey

Quinoil Industries, Inc.
Quincy, Massachusetts

The Sico Company
Wilmington, Delaware

C.H. Sprague & Son Company
Boston, Massachusetts

Steuart Petroleum Company
Piney Point, Maryland

Swann Oil, Inc.
Bala Cynwyd, Pennsylvania

Webber Tanks, Inc.
Bucksport, Maine

Wyatt, Inc.
New Haven, Connecticut

The 16 companies listed above own and control terminals capable of receiving ocean-going tankers. None are affiliated with a major integrated oil company. Members of the Association are independent marketers of No. 2 fuel oil, No. 6 fuel oil, gasoline and other petroleum products.

They distribute nearly 50% of the No. 2 fuel oil consumed in New England and nearly 30% of the No. 2 fuel oil consumed along the East Coast. They distribute nearly 60% of the residual fuel oil burned by non-utility consumers in New England and nearly 50% in the Middle Atlantic states.

The 16 companies own and control 56 deepwater terminals and 40 barge terminals, with a total storage capacity of more than 57 million barrels. Of the total, about 26 million barrels are for No. 2 fuel oil, about 24 million barrels are for residual fuel oil, and about 7.4 million barrels are for gasoline and other products.

Senator WARNER. The current undertaking of the Department of Energy is studying interim storage, abandoned geographical SPR. What has been the input of your organization?

Mr. BUCKLEY. We have visited with the DOE and we have urged them to consider regional storage for both crude oil and products. We believe that—the Congress has given the DOE very clear objectives of developing salt dome storage up to three-quarters of a million barrels, but those objectives may not be reached and we may have to go at a lower fill rate, because of the unavailability of appropriate storage and so we think that over the next 3 to 5 to 6 years an interim program that allows this fill rate to continue, particularly in the absence of any other planning for emergency, is crucially important.

I just cannot stress to you enough, I know there is a very popular theory that Government regulations do not work and I am one who has excoriated them and complained about them very bitterly over the last 8 years, because we had a system put into place in a shortage emergency situation that went on for 8 years and had no flexibility built in.

But in point of fact if you go back to 1973 when there was no legislation, we had runouts in the fall and in the late winter of that year, the President had to open up the oil import program because there were physical shortages, systems closed down. It was all before the embargo.

When the embargo hit, five of our six main suppliers, and our company supplies about a half-million people in our day with home heating oil and supplies other gasoline and residual fuel as well. We are one of the two or three largest suppliers in the New England region, five of our six main suppliers shut us off without a drop.

Now, at that time the Government, I cannot remember, the Office of Emergency Preparedness had 10 people who worried about energy, they made some calls to major oil companies. And the oil companies said, look, we have to protect the interest of our shareholders; it is a free market. There was no way you could ask them to do something that was not consistent with their objectives.

But the net result was we had to go out, because we knew we had to have the oil and we bought it at triple the price available here. We were selling it under our rack for 37 cents a gallon. Right next door major companies were selling it for 12 cents a gallon.

People did not understand why their oil bills doubled overnight and their neighbors did not have any increase at all. But it was either that or run out of oil.

So the companies cannot always act in the national interest and cannot always act responsibly. And there is no stick in the closet to force them to. And we are just going to depend on the market, but we are not going to include the gas market. We are just going to rely on oil and it is already being used very efficiently and we are forced by the market to carry minimum stocks. We are just plain naked, absolutely naked on the east coast.

And we are now getting the DOE and forcing them to look at regional storage for crude and products. All we have left at that point is Treasury and I am not sure that is enough, given the way the world is going right now.

Senator **Warner**. I have to preside at 3 o'clock. We are going to put into the record your entire statement and I am very grateful and on behalf of the committee for your presentation today.

Mr. **Buckley**. We appreciate your leadership in this issue, Mr. Chairman.

Senator **Warner**. Let us see what the results are.

Cecil A. Wooten, treasurer, Steel Plate Fabricators Association.

STATEMENT OF CECIL A. WOOTEN, TREASURER, STEEL PLATE FABRICATORS ASSOCIATION, CHICAGO, ILL., ACCOMPANIED BY FRANK LASKER, PRESIDENT, STEEL PLATE FABRICATORS ASSOCIATION

Mr. **Wooten**. This is Frank Lasker, who is president of the association.

Senator **Warner**. Your statement is in here?

Mr. **Wooten**. That is right. It is right after the table of contents. I will not be following the written statement. I will go through it rather quickly, because many of the things in the statement have already been covered.

The association is an organization representing 145 companies that employ approximately 50,000 people. We are vitally interested in the strategic petroleum reserve, both as it effects the security of our country and as a means to reduce unemployment in our industry.

We have already established the fact that Congress wishes to fill the strategic petroleum reserve at 300,000 barrels per day and the current program for providing the storage is not adequate to meet that target. These facts have encouraged the association to study the effect the use of steel tanks could have on the program's schedule.

The results of our study are incorporated in the written statement. The Corps of Engineers agrees with our acceleration and analysis and has further indicated that aboveground terminals are cost effective and we have heard a lot of comments to the contrary, but both the DOE and the corps have agreed when considering the price of oil and the time of purchase that aboveground steel tanks are cost effective.

We also recognize that the DOE studies have been made on the basis that it is not cost effective unless there is a near-term interruption in supplies. And we call to your attention that in 1973 when we had our crisis that interruption was not seen in 1972. So we do not think that is a very good basis for making a decision.

In addition to providing a means of accelerating the storage availability on a cost-effective basis, aboveground storage provides important characteristics which complement existing facilities by giving the program additional flexibility. I will go through some of these advantages we find.

Steel tanks allow segregation of oil by grades providing the Government greater flexibility in their purchasing program and enabling crude withdrawal for specific refineries designed to process that particular crude. That statement means that there are many refineries in the United States who do not have the capability of refining certain types of crude and with it all concentrated in one area, the crudes get mixed and you do not have that ability to segregate the crudes and feed them to the refineries that have the proper capability.

Steel tankage permits geographic dispersion of storage and crude segregation where inground storage dictates concentration.

The Corps of Engineers letter, incorporated in our written statement, points out the advantage of 100 percent oil recovery in steel tanks versus unknown recovery in solution minesites. It further states that the DOE admits to a 1.5-percent recovery loss and a 5-percent loss is regarded as more realistic based on the many unknowns inherent in a long-term storage in solution-lined cabinets.

This loss factor, which if it were 5 percent, would be $1.50 or so per barrel, has not been considered in the DOE cost analysis. The viability of steel tanks is not affected by the number of drawdowns. Whereas inground storage in salt domes is limited to a few drawdowns. Therefore steel tanks will permit partial use of the reserves if necessary and desirable on a periodic basis without affecting the useful life of the reserve program.

Steel tanks can be converted to product storage tanks, such as gasoline, fuel oil, jet fuel, should the need arise. That has been brought out here that there is a need for product storage tanks.

Now, the prime advantage of aboveground storage is a 2- to 4-year acceleration in the current fill schedule for the 750-million-barrel program. These charts demonstrate this acceleration. Now, the first chart simply says at the end of 1981 we had 200 million barrels of storage in place and if we filled at the rate of 300,000 barrels per day, we would have the storage in place until the end of 1986. Now that is the target fill rate of 300,000 barrels per day.

Turning to the second chart this is the availability of the storage for the schedule of the present DOE except it has been delayed 1 further year. This shows it is available at the end of 1989 and the DOE has indicated that Big Hill has been delayed 1 year, which will mean the end of 1990.

The next chart puts the two together and you can see the shortfall in between the curves. The next chart shows what might be available with the use of aboveground steel storage new. Now, in addition to what this shows the Corps of Engineers has recently completed a site specific study indicating that there is land available, Government-owned land presently, where this 100 million barrels can be put and this start could be moved from the middle of 1985 to the middle of 1984 and then if we are talking about 1990, we have a 4-year improvement in the schedule.

The next chart shows how putting that in steel tanks would show, this shows a 2-year improvement. But if we can move back to 1984 based on the site specific study of the Corps of Engineers, we could have the strategic petroleum reserve in place, 750 million barrels, by the end of 1986 in accordance with the previous target on the part of commerce.

There has been some discussion about cost and I might point out that it was mentioned that if you go to interim storage it may be a 3- to 5-year interim that you are storing and at $2 a barrel you are talking about from $6 to $10 as the cost.

If you do choose to use interim storage on the temporary basis to get immediate oil in place and we go to a permanent aboveground storage for, say, the Big Hill project, then we could have the permanent storage in place by several years earlier than if we wait for the salt domes and can make the savings even greater.

There is also some talk about the mine storage and one question that we looked at with regard to steel tanks is that these tanks can be placed along existing networks and the Corps of Engineers site specific study has come up with a total one time cost of slightly less than $7 per barrel, including the connection to an existing pipeline.

If we go to some other kind of installation, it means that a pipeline or a transportation system has to be built to get it to the refineries and that transportation might have to be in place because we are talking about strategic petroleum and if we have an emergency we are not going to have time to go around and look for a lot of barges and a lot of ships to start using it.

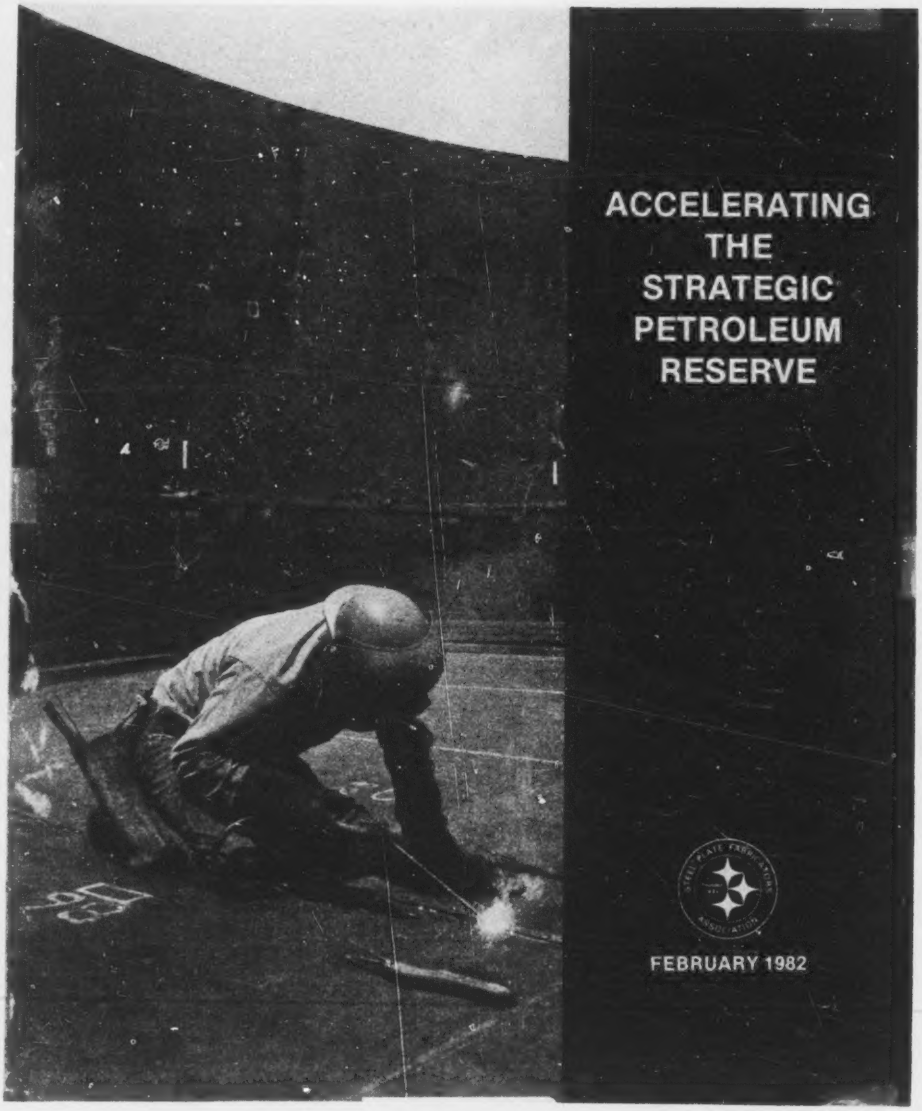
Whereas if it is in steel tanks adjacent to an existing line, we immediately have the capability of turning on the pumps and getting the oil out. Now, we had a picture up here, which is there now, and the size tanks we are talking about are 1,250,000 barrels, which is the ones in the background. The ones in the front are 1,500,000 barrels. So we are talking about 40 of those tanks for a 50-million-barrel terminal,

The construction of three 50-million-barrel terminals will have a major impact as was indicated by Mr. Carmichael on the depressed steel and construction industries. In addition to being cost effective, it would also place a lot of people on the employment roles and consequently the ripple effect of the taxes paid and everything would even reduce the cost more.

Since Congress has recently attached emergency to the SPR, we conclude that it is desirable to accelerate the construction of storage facilities. And the question of urgency deserves immediate resolution. Our industry is prepared to move expeditiously and to assist in the early completion of the SPR.

Thank you.

[The prepared statement and materials submitted by Mr. Wooten follow:]



ACCELERATING THE STRATEGIC PETROLEUM RESERVE

STEEL PLATE FABRICATORS ASSOCIATION

FEBRUARY 1982

ACCELERATING THE STRATEGIC PETROLEUM RESERVE ("SPR")

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March 25, 1982

STATEMENT OF CECIL A. WOOTEN

Representing the
Steel Plate Fabricators Association
Before the Subcommittee on
Energy and Mineral Resources

I am Cecil Wooten, Treasurer of the Steel Plate Fabricators Association, headquartered in the Chicago area. With me is Frank Lasker, President of the Association. During this statement, I will refer to the Steel Plate Fabricators Association as the Association.

Thank you for the opportunity to state the position of the Association. We have prepared a written statement for inclusion in the record.

The Association is an organization representing 145 companies that employ approximately 50,000 people. We are vitally interested in the Strategic Petroleum Reserve both as it affects the security of our country, and as a means to reduce unemployment in our industry.

We believe it is the intent of Congress to fill the Reserve as quickly as possible. In fact, while the law requires a minimum fill rate of 100,000 barrels per day, Congress has encouraged a fill rate of at least 300,000 barrels per day. Regretably, the present storage construction program will not allow this desired fill rate.

These facts have encouraged the Assocation to study the effect the use of steel tanks could have on the program's schedule. The results of our study are incorporated in the written statement. The study clearly shows that storage availability can be accelerated by proceeding immediately with above ground steel tank terminals.

The U.S. Corps of Engineers agrees with our acceleration analysis and has further indicated that above ground terminals are cost effective. This is evidenced in their letter included in our written statement.

The DOE Report, dated July, 1981, entitled "Strategic Petroleum Reserve Acceleration", also concludes that in terms of overall budget costs, "steel tanks are less expensive than a new solution-mined site and competitive with Big Hill alternatives because the oil would be acquired sooner" (see page III-3, Section 4 of our written statement). However, the same report also looks at an investment analysis and concludes that accelerated oil procurement is not a good investment unless a near term supply interruption is foreseen.

The interruption in oil supply that occurred in 1973 was not foreseen in 1972. The SPR was an outgrowth of the 1973 crisis to provide insurance against similar interruptions in the future. The conclusions of the DOE do not consider the likelihood of a near term interruption.

In addition to providing a means for accelerating storage availability, on a cost effective basis, above ground storage provides important characteristics which complement existing facilities by giving the program additional flexibility:

1. Steel tanks allow segregation of oil by grades providing the government greater flexibility in their purchasing program and enabling crude withdrawal for specific refineries designed to process that particular crude.

2. Steel tankage permits geographic dispersion of storage and crude segregation where inground storage dictates concentration.

3. The Corps of Engineers' letter, incorporated in our written statement, points out the advantage of "one hundred percent oil recovery in steel tanks versus unknown recovery in solution-mined sites". It further states that "DOE admits to a 1.5% recovery loss. A 5% loss is regarded as more realistic based upon the many unknowns inherent in long-term storage in solution-mined cavities". This loss factor has not been considered in the DOE storage cost analysis.

4. The viability of steel tanks is not affected by the number of drawdowns whereas inground storage in salt domes is limited to a few drawdowns. Therefore, steel tanks will permit partial use of the reserve, if necessary or desirable, on a periodic basis without affecting the useful life of the reserve program.

5. Steel tanks can be converted to product storage such as gasoline, fuel oil, jet fuel, etc. should the need arise.

The prime advantage of above ground storage is a two year acceleration in the current fill schedule for the 750 million barrel program. These charts demonstrate this acceleration:

CHART 1 - shows 200 million barrels of crude in storage at the end of FY 1981. By adding to that storage at the fill rate of 300 thousand barrels per day targeted by Congress, the entire 750 million barrels should be in place by the end of FY 1986.

CHART 2 - based on the present "accelerated" DOE Facility development schedule, the 750 million barrel fill capacity, using inground storage, cannot be attained until the end of FY 1989.

CHART 3 - combines Charts 1 and 2, showing a short fall between the target fill rate set by Congress and the availability of storage as currently planned. The 750 milion barrel storage capacity will be in place 3 years late.

CHART 4 - illustrates that storage in steel tanks can be made available, starting mid FY 1985, with 150 million barrels available by the end of FY 1987.

CHART 5 - shows that with the use of steel tanks, the full 750 million barrels of storage can be in place by the end of FY 1987, eliminating the need for the Big Hill Development and providing the full storage capability two years earlier than will be the case if Big Hill goes forward.

The construction of the three 50 million barrel terminals referred to in these charts will have a major impact on the presently depressed steel and construction industries. 420,000 tons of steel are required which translates into 1,700 steelworker man years, and in addition, creates employment for workers in mining, shipping and other related areas that go hand in hand with steel making.

The construction of the terminals translates into 6,150 man years of work. This industry, which Mr. Lasker and I represent, is suffering from a lack of new construction in this country, resulting from the decline in the rate of expansion of refining and power generation capacity.

The leaching of caverns requires considerable power and water which account for most of the construction cost, but is not labor intensive. Steel tankage is labor intensive and will provide more employment.

Since Congress has previously attached urgency to the SPR, we conclude it is desirable to accelerate the construction of storage facilities. The question of urgency deserves immediate resolution. Our industry is prepared to move expeditiously, to assist in the early completion of the SPR.

Thank you.

APPENDIX - B

THE FOLLOWING FIVE CHARTS ILLUSTRATE THE EFFECT 3 - 50MMB STEEL TANK STORAGE FACILITIES COULD HAVE ON THE CURRENT SPR DEVELOPMENT PROGRAM.

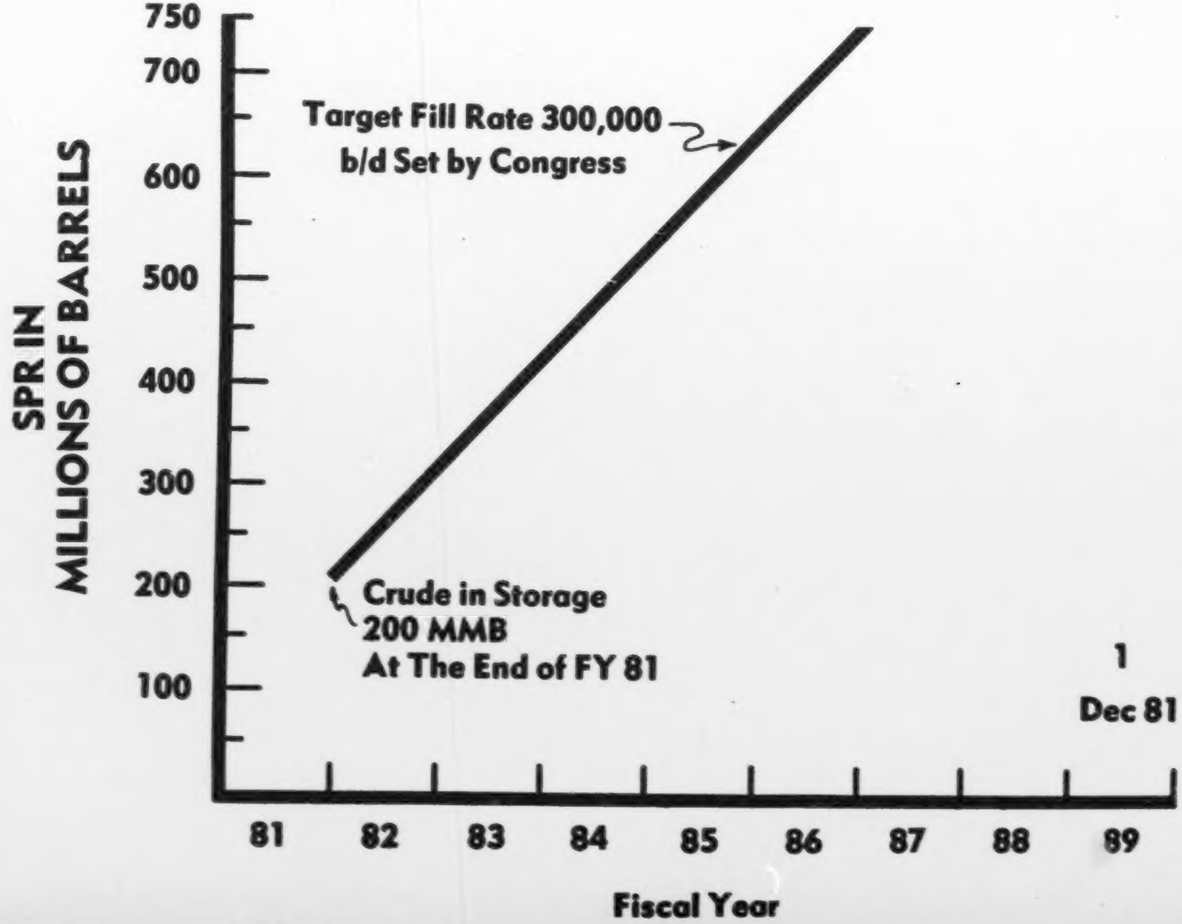
CHART 1 - SHOWS 200MMB OF CRUDE IN STORAGE AT THE END OF FY 1981. BY ADDING TO THAT STORAGE AT THE FILL RATE TARGETED BY CONGRESS, THE ENTIRE 750MMB SHOULD BE IN PLACE BY THE END OF FY 1986.

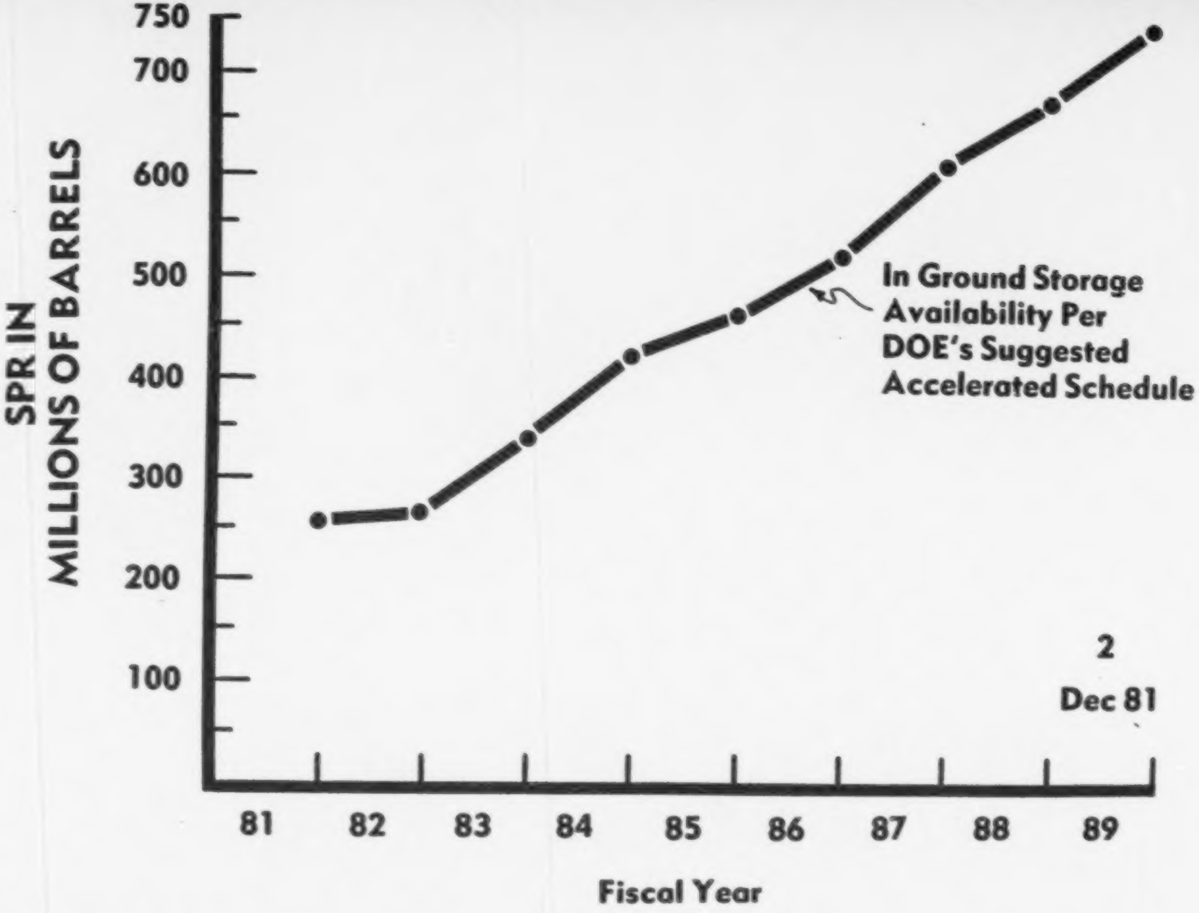
CHART 2 - BASED ON THE 'ACCELERATED' DOE FACILITY DEVELOPMENT SCHEDULE SHOWN IN TABLE IV.1, PAGE IV-3 OF DOE'S JULY, 1981 REPORT, THE 750MMB FILL CAPACITY CANNOT BE ATTAINED UNTIL THE END OF FY 1989.

CHART 3 - COMBINES THE INFORMATION ON CHARTS 1 AND 2, SHOWING A SHORT FALL BETWEEN THE TARGET FILL RATE SET BY CONGRESS AND THE AVAILABILITY OF STORAGE AS CURRENTLY PLANNED. THE 750MMB STORAGE CAPACITY WILL BE IN PLACE 3 YEARS LATE.

CHART 4 - ILLUSTRATES THAT STORAGE IN STEEL TANKS COULD BE MADE AVAILABLE, STARTING MID FY 1985 WITH 150MMB AVAILABLE BY END FY 1987.

CHART 5 - SHOWS THAT WITH THE USE OF STEEL TANKS, THE FULL 750MMB OF STORAGE CAN BE IN PLACE BY END OF FY 1987, ELIMINATING THE NEED FOR THE BIG HILL DEVELOPMENT AND PROVIDING THE FULL STORAGE CAPABILITY 2 YEARS EARLIER THAN WILL BE THE CASE IF BIG HILL GOES FORWARD.

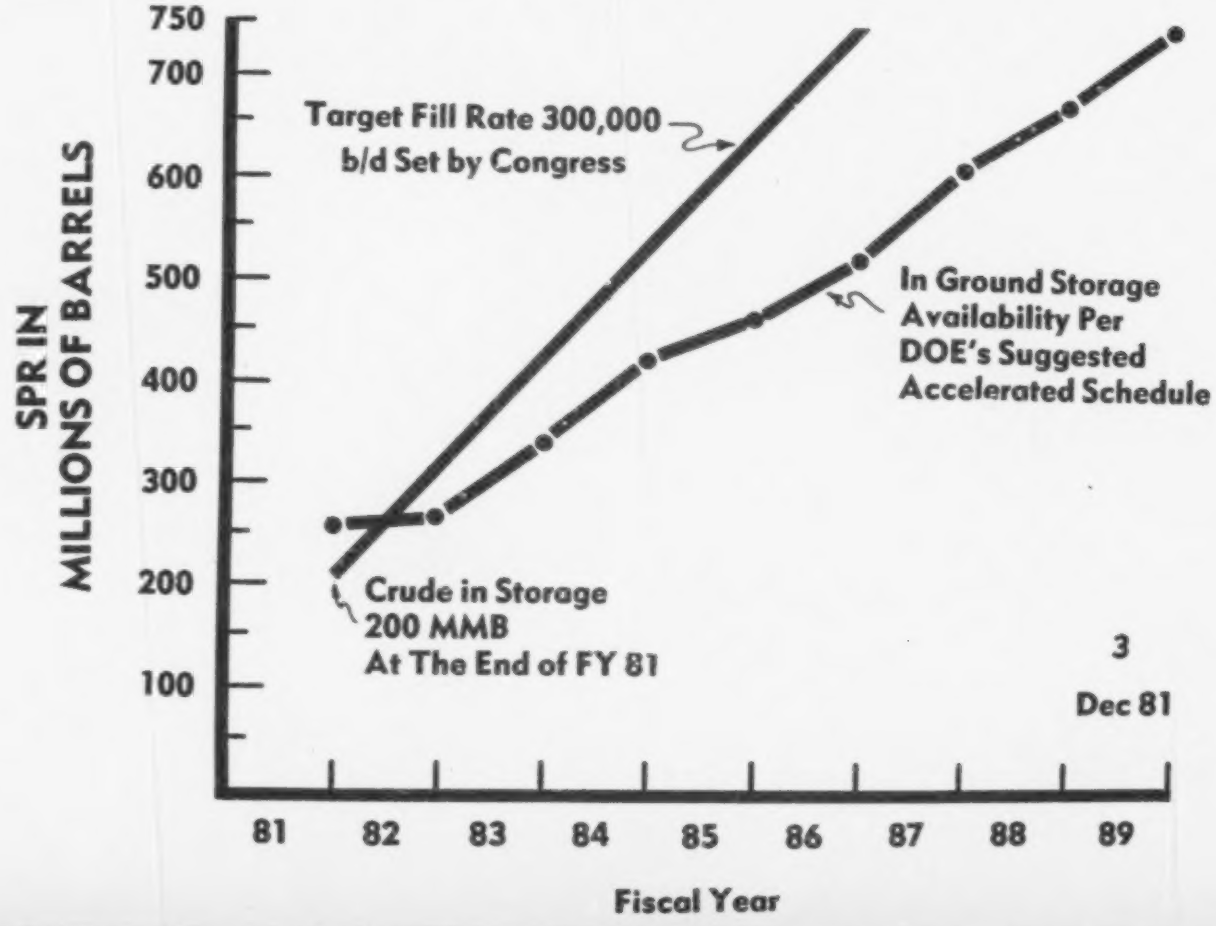

SPR IN
MILLIONS OF BARRELS
750
700
600
500
400
300
200
100
Target Fill Rate 300,000
b/d Set by Congress
Crude in Storage
200 MMB
At The End of FY 81
1
Dec 81
81
82
83
84
85
86
87
88
89
Fiscal Year

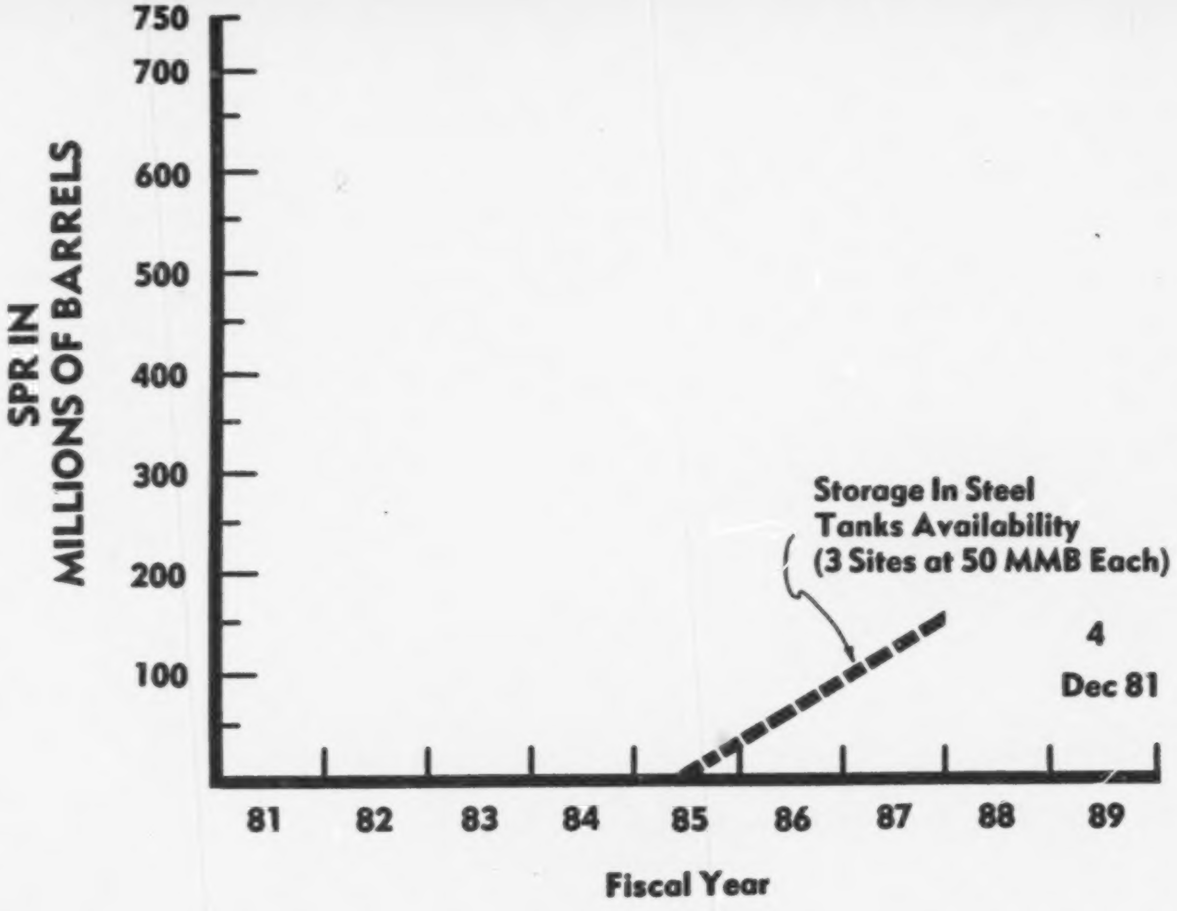


In Ground Storage Availability Per DOE's Suggested Accelerated Schedule

2

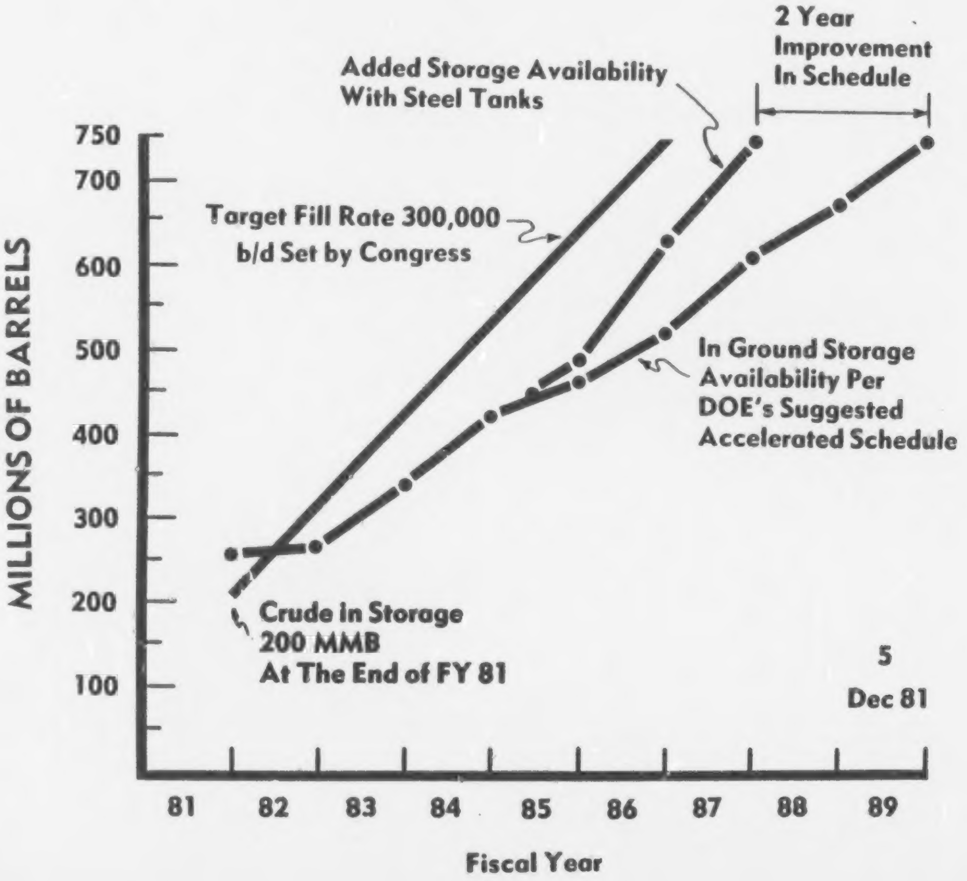
Dec 81


SPR IN
MILLIONS OF BARRELS
750
700
600
500
400
300
200
100
81
82
83
84
85
86
87
88
89
Fiscal Year
Target Fill Rate 300,000 b/d Set by Congress
In Ground Storage Availability Per DOE's Suggested Accelerated Schedule
Crude in Storage 200 MMB At The End of FY 81
3
Dec 81


SPR IN
MILLIONS OF BARRELS
750
700
600
500
400
300
200
100
81
82
83
84
85
86
87
88
89
Fiscal Year
Storage In Steel
Tanks Availability
(3 Sites at 50 MMB Each)

4

Dec 81


2 Year
Improvement
In Schedule
Added Storage Availability
With Steel Tanks
Target Fill Rate 300,000
b/d Set by Congress
In Ground Storage
Availability Per
DOE's Suggested
Accelerated Schedule
Crude In Storage
200 MMB
At The End of FY 81
5
Dec 81
SPR IN
MILLIONS OF BARRELS
750
700
600
500
400
300
200
100
81
82
83
84
85
86
87
88
89
Fiscal Year

APPENDIX - C
TABLE 1

Date February 1982

COST ESTIMATES FOR A 50-MMB STEEL TANK STORAGE FACILITY
(All costs in Jan. 1982 Dollars)

($ in thousands)

	FY 1982	FY 1983	FY 1984	FY 1985	FY 1986	FY 1987	TOTAL
PLANNING/EIS/PERMITS	1,250	250					$ 1,500
REAL ESTATE	500	8,300					8,800
DESIGN	2,000	1,500					3,500
CONSTRUCTION MANAGEMENT	By DOE	By DOE	By DOE	By DOE	By DOE	By DOE	By DOE
Facil (elect, mech & civil)		6,020	27,300	29,270	23,500	3,530	89,620
Storage Tanks (incl Foundations)		31,640	78,230	80,990	56,840	6,600	254,300
Pipelines		—	—	—	—	—	—
Power		140	630	810	550	150	2,280
O&M THRU FILL	—	—	—	By DOE	By DOE	By DOE	By DOE
CONSTRUCTION MANAGEMENT (COE or DOE staff)	By DOE	By DOE	By DOE	By DOE	By DOE	By DOE	By DOE

TOTAL COST EXCLUDING O&M AND CONSTRUCTION MANAGEMENT $360,000
($7.20/Bbl)

NOTES

1) Real Estate Estimate based on 1100 acres at $8,000/acre.

2) The Costs shown for "Planning, EIS & Permits" represents Contractor assistance to the DOE in obtaining such permits and approvals.

3) Above Pricing includes Contractor supervision of intial fill on a module by module basis (5MMB per module). All other O&M Costs to be borne by DOE.

APPENDIX - D

DESCRIPTION OF 50MMB FACILITY

1. The facility consists of:

   a) 40 - 403 foot diameter by 60 foot high Type 5 pontoon floating roof tanks.

   b) Capacity of each tank is 1.25 MM Bbls.

   c) Facility requires approximately 1100 acres of land area.

   d) Foundations shall consist of compacted fill covered by an oiled sand cushion and surrounded by a crushed stone ringwall.

   e) Design fill rate is 350,000 Bbl per day. Design Pumpout rate is 266,750 Bbl per day.

   f) All product entering and leaving the facility will be monitored by a flow meter and recorded in the terminal control room.

   g) Security will be provided by fencing using a microwave intrusion detector system and by a television monitoring system consisting of eight remote control T.V. cameras and monitors.

   h) Fire protection will be provided by a combination of wet fire protection via a hydrant system, a fixed foam system for the storage tank seal area and the product pump areas, dry chemical extinguishers provided as both hand held and wheeled units, and a detection system located throughout the building area.

2. Present steel deliveries indicate that material would start arriving at fabrication plants within 10 to 12 weeks from date of contract. Therefore, the ordering of material, delivery to plants, fabrication and shipment of fabricated material could all be accomplished so that tank construction on Module 1 can proceed within six months from receipt of E.I.S. approval and all necessary permits.

   The required site clearing, grading, and construction of foundations for the tanks in Module 1 would also be completed in this six month period.

   The attached bar chart schedule shows construction of the tanks for Module 1 starting in July of 1983 with the module being completed and ready to receive oil by the first of April, 1985.

   The schedule shows that work would start on a new module area every 3 to 4 months and that about 12 tanks would be worked on at any one time. The testing, painting, and completion of piping would follow the tank construction after which three months would be allowed for commissioning prior to fill.

3. The pricing includes for Contractor participation in assisting the DOE in obtaining necessary permits and preparation of the Environmental Impact Statement.

4. The pricing and scheduling attached is based on completing the facility in 5MMB modules and turning each module over to the DOE upon completion prior to fill. Operation and maintenance from this point forward would be by DOE. However, Contractor will provide technical assistance and/or supervision during fill and will be responsible during this period for seeing that facility performs as designed. As the modules are turned over temporary security precautions will be taken to isolate the completed work from that still under construction.

5. The land pricing shown is based on a conservative figure of $8,000 an acre. It would be hoped, however, that sufficient government property near existing major crude arteries could be located to avoid purchasing of additional land which would not only reduce the cost somewhat, but also accelerate schedule.

6. The pricing and scheduling are based on Contractor designing, supplying, constructing, testing and commissioning the complete facility. Contracting could be on a lump sum basis, subject only to escalation.

APPENDIX - E

SCHEDULE FOR 50-MM BBL SPR TERMINAL

Attached is the construction schedule for a 50-MMB facility.

This schedule is based on the following conditions:

1. The site is located adjacent to an existing crude pipeline and is reasonably level with soil bearing conditions adequate to allow the construction of tanks 403' in diameter and 60' in height. Foundations to be gravel berm and oiled sand cushion. No allowance for rock excavation or measures to overcome poor soil conditions have been considered.
2. DOE award of January 1, 1982.
3. Site selection with suitability studies complete by April 1, 1982.
4. Final design, advanced billing of tank material, piping and equipment complete by January 1, 1983.
5. Permits and environmental impact approvals complete by January 1, 1983.
6. Release by January 1, 1983 to place orders for steel, equipment, detail engineering of tanks and release of civil subcontractors.
7. A Southern U.S. location.

APPENDIX - E

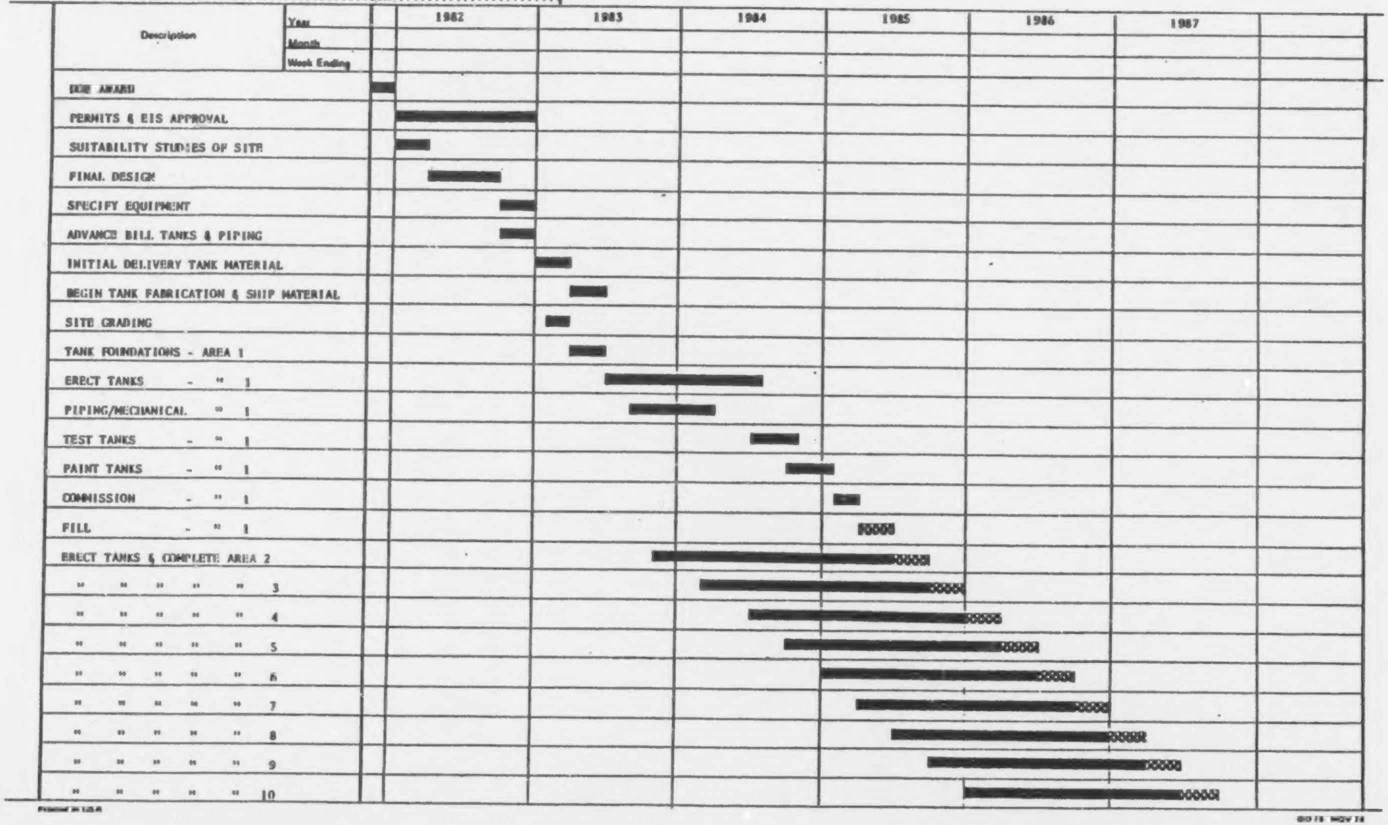
Schedule

Project . 50 MM BBL SPR . . STEEL STORAGE TANKS . . . Prepared by. . . . .

Customer. . DEPARTMENT OF ENERGY . . . .

Cust. Ref No. . . . . Date. February 1982

Legend



SECTION - 1

EXECUTIVE SUMMARY

EARLY LAST YEAR, CONGRESS DIRECTED THE PRESIDENT TO 'SEEK TO UNDERTAKE' AN AVERAGE OIL FILL RATE OF 300,000 BARRELS PER DAY FOR THE NATIONS STRATEGIC PETROLEUM RESERVE. AT THE TIME OF THIS DIRECTIVE, HOWEVER, THE BUDGETED STORAGE DEVELOPMENT PROGRAM WOULD RESTRICT FILL TO AN AVERAGE OF 189,000 BPD.

THE DOE UNDERTOOK A STUDY TO LOOK AT VARIOUS POSSIBILITIES FOR ACCELERATING THE PROGRAM. THEIR FINDINGS WERE INCLUDED IN A REPORT DATED JULY 1981 (SEE SECTION 4 OF THIS BOOKLET).

IN BRIEF, THE DOE'S REPORT CONCLUDES THAT LITTLE CAN BE DONE TO ACCELERATE FACILITY DEVELOPMENT. IT ALSO CONCLUDES THAT THE COMPOSITION OF THE RESERVE AS ORIGINALLY PLANNED IS STILL THE PREFERRED COMPOSITION. THIS COMPOSITION CONSISTS OF A 'BASE MODULE' OF 580MMB WHICH IS TOO FAR ALONG IN DEVELOPMENT TO CHANGE, PLUS A 30MMB EXPANSION AT WEST HACKBERRY AND A NEW 140MMB "GRASS ROOTS" SOLUTION MINED DEVELOPMENT AT BIG HILL, TEXAS.

THE FOLLOWING COMPARES THE FY 1982 BUDGETED PROGRAM WITH THE SLIGHTLY ACCELERATED PROGRAM AS CONTAINED IN THE DOE'S STUDY.

OIL FILL CAPACITY
(CUMULATIVE MMB, END OF FISCAL YEAR)

	1982	1983	1984	1985	1986	1987	1988	1989
1. FY 1982 BUDGET	261	331	398	409	481	605	687	750
2. DOE'S ACCELERATED PROGRAM	267	343	417	456	538	611	670	750

SPFA HAS STUDIED THE EFFECT A QUANTITY OF STEEL TANKS WOULD HAVE ON THE PROGRAM'S SCHEDULE. THE FOLLOWING SUMMARIZES ITS FINDINGS:

BY REPLACING THE BIG HILL SALT DOME WITH THREE 50MMB STEEL TANK TERMINALS, TWO YEARS CAN BE CUT FROM THE CURRENT FILL SCHEDULE.

THIS ACCELERATION WOULD PERMIT AN AVERAGE DAILY FILL THROUGH COMPLETION OF THE 750MMB PROGRAM OF 265,000 BPD OR 88 PERCENT OF THAT TARGETED BY CONGRESS. THE CUMULATIVE AVAILABLE CAPACITY AT THE END OF EACH FISCAL YEAR IN RELATION TO THE DOE'S ACCELERATED PROGRAM WOULD BE AS FOLLOWS:

OIL FILL CAPACITY
(CUMULATIVE MMB, END OF FISCAL YEAR)

	1982	1983	1984	1985	1986	1987	1988	1989
ALT. WITH STEEL TKS.	267	343	417	486	628	750	---	---
DOE'S ACCELERATED PROGRAM	267	343	417	456	538	611	670	750

THE CHARTS ATTACHED (CONTAINED IN APPENDIX B TO THE INTRODUCTION OF THIS BOOKLET) GRAPHICALLY ILLUSTRATE THE EFFECT STEEL TANKAGE COULD HAVE ON THE OVERALL FILL PROGRAM.

IN ADDITION TO OFFERING EARLY COMPLETION, STEEL TANKAGE WOULD BE COST EFFECTIVE WHEN CONSIDERING THE COST OF FACILITY DEVELOPMENT TOGETHER WITH THE COST OF THE FILL. THE REASON BEING SIMPLY THAT EARLY COMPLETION OF STORAGE PERMITS EARLY

PURCHASE OF OIL - AT PRESUMABLY LOWER COST. THE CORPS OF ENGINEERS' RESPONSE TO A CONGRESSIONAL INQUIRY (ATTACHED IN SECTION 3) HEREIN, CLEARLY SUPPORTS THIS STATEMENT.

THE DOE REPORT OF JULY 1981 ALSO SUPPORTS THE COST EFFECTIVENESS OF STEEL TANKAGE CONSIDERING 'NOMINAL' (ACTUAL OUTLAY OR ESCALATED) DOLLARS. HOWEVER, THE REPORT ALSO CONSIDERS A 'PRESENT VALUE' INVESTMENT ANALYSIS WHICH CONCLUDES THAT STEEL TANKS ARE NOT COST EFFECTIVE.

IN ARRIVING AT THE SO CALLED 'PRESENT VALUE', THE DOE ASSUMES AN ANNUAL REAL GROWTH IN OIL PRICING OF ONLY 3 PERCENT WHILE SETTING THE REAL DISCOUNT RATE AT 10 PERCENT. THIS RELATIONSHIP OF GROWTH TO DISCOUNT RATE, PENALIZES EARLY FACILITY COMPLETION AS ACKNOWLEDGED IN THE DOE REPORT. (SEE SECTION 4, PAGE III-4)

THE PRESENT VALUE INVESTMENT ANALYSIS SEEMS ONLY TO POINT OUT THAT STOCK PILING OF OIL CANNOT BE JUSTIFIED BY THE POTENTIAL RETURN ON INVESTMENT. RATHER, IT IS INTENDED TO BE INSURANCE PROTECTION AGAINST A POTENTIAL LOSS OF $200 IN GNP FOR EACH UNAVAILABLE BARREL DURING A SUPPLY SHORTAGE SITUATION.

ALTHOUGH THERE MAY BE SEVERAL CONSIDERATIONS IN THE FINAL SELECTION OF A STORAGE FACILITY, SURELY TWO OF THE MOST IMPORTANT ARE, EARLY COMPLETION AND TOTAL BUDGET OUTLAY DOLLARS. STEEL TANKAGE RATE WELL ON BOTH ACCOUNTS.

IN ADDITION TO THE FOREGOING COST AND SCHEDULE ADVANTAGES, A QUANTITY OF ABOVE GROUND STORAGE WOULD COMPLEMENT THE PRESENT IN-GROUND RESERVE BY ADDING OPERATIONAL FLEXIBILITY TO THE SPR PROGRAM. IT WOULD ALSO BE A GREAT BOOST TO THE PRESENTLY DEPRESSED STEEL AND CONSTRUCTION INDUSTRIES.

SUCH A CHANGE IN THE PROGRAM WOULD HAVE TO TAKE PLACE QUICKLY TO TAKE ADVANTAGE OF THE FULL TWO YEAR ACCELERATION.

SECTION 2

THE FOLLOWING LISTS MANY OF THE FAVORABLE CONSIDERATIONS WHICH SHOULD BE GIVEN TO THE CONCEPT OF ABOVE GROUND STEEL STORAGE IN ADDITION TO THE COST EFFECTIVENESS AND SCHEDULING IMPROVEMENTS.

1. THE CONSTRUCTION OF ABOVE GROUND STEEL TANK TERMINALS WOULD REQUIRE FEWER DOE OR CORPS SUPERVISORY PEOPLE. THE CONTRACTOR WOULD PROVIDE COMPLETE ENGINEERING AND OUTSIDE CONSULTING WOULD NOT BE REQUIRED.

2. ABOVE GROUND STORAGE HAS ADVANTAGES IN GRAVITY FLOW WHICH RESULTS IN LOW POWER REQUIREMENTS.

3. EXCEPT FOR A FEW PUDDLES, ALL OF THE CRUDE IN STORAGE IS RECOVERABLE FROM ABOVE GROUND STEEL TANKS.

4. ABOVE GROUND STEEL TANKS COULD BE USED TO STORE PRODUCTS OTHER THAN CRUDE OIL.

5. IF THE GOVERNMENT EVER DECIDED TO DISPOSE OF THE RESERVE, ABOVE GROUND TERMINALS COULD BE SOLD OR WOULD HAVE CONSIDERABLE SCRAP VALUE.

6. THE CRUDE IN ABOVE GROUND STEEL TANKS IS STORED AT ATMOSPHERIC PRESSURE, THEREBY ELIMINATING ANY RISKS OF BLOWOUTS.

7. VARIOUS GRADES OF CRUDE AND PRODUCTS CAN BE SEGREGATED IN ABOVE GROUND TANKS ALLOWING OPERATING FLEXIBILITY.

8. REGULAR INSPECTION FOR POSSIBLE LEAKS IN ABOVE GROUND STEEL TANKS IS VISIBLE AND EASILY REPAIRABLE. ABOVE GROUND STORAGE WOULD BE IN MANY TANKS, SO THE RISK OF A CATASTROPHIC TYPE LOSS WOULD BE REMOTE.

9. THE CRUDE COULD BE STORED IN AREAS AROUND THE U.S. CLOSE TO THE POINTS OF USE, THEREBY RELIEVING SOME OF THE REGIONAL PROBLEMS IN CASE OF EMERGENCY DRAWDOWN.

10. DISPERSAL OF THE RESERVE IS ONE OF THE BEST WAYS TO PRESERVE THE SECURITY OF THE CRUDE STORAGE.

11. THE NUMBER OF DRAWDOWNS FOR ABOVE GROUND STEEL TANKS IS ALMOST UNLIMITED. IT WOULD BE DETERMINED BY THE LIFE OF THE TANKS.

12. SUFFICIENT GOVERNMENT OWNED LAND COULD BE MADE AVAILABLE AT VARIOUS SITES WHICH WOULD BE A GREAT ASSISTANCE IN THE PERMITTING AND THE LAND ACQUISITION SCHEDULES.

13. AT THIS TIME OF UNEMPLOYMENT, THESE ABOVE GROUND STEEL TANK TERMINALS WOULD PROVIDE A GOOD BOOST TO THE U.S. STEEL AND CONSTRUCTION INDUSTRIES. 100MMB OF STORAGE WOULD REQUIRE APPROXIMATELY 300M TONS OF STEEL PLATE WITH THE ASSOCIATED MANHOURS OF WORK IN MANY INDUSTRIES.

SECTION 3

DEPARTMENT OF THE ARMY
OFFICE OF THE CHIEF OF ENGINEERS
WASHINGTON, D.C. 20314

REPLY TO
ATTENTION OF:
DAEN-MPE

Honorable Carroll Hubbard
House of Representatives
Washington, DC 20515

Dear Mr. Hubbard:

This is a followup to the interim response on correspondence from Mr. A. A. Albertson, Vice President, CBI Industries Inc. regarding the Strategic Petroleum Reserve.

The Corps provides DOE with professional management and technical services in support of the development of the Strategic Petroleum Reserve under a Master Interagency Agreement since early 1979. The primary role of the Corps as deliniated in the MIA is to manage the design and construction of the SPR's expansion from Phase II to the 750MMB total for Phase III. Under this agreement we participated in the Source Evaluation Board for the competitive turnkey solicitation which was intended to meet the Phase III requirements; conducted planning studies for the Regional Reserve; and developed cost and schedule data for above ground storage facilities. The above ground storage cost and schedule estimates were provided to DOE for use in the acceleration study.

The information and cost comparisons contained in Mr. Albertson's inquiry have been evaluated. In order to fully evaluate the data, we obtained from DOE the Acceleration Report, dated July 1981 and analyzed it along with other data we have received. Comparisons of the various schedules and cost data for development of 100MMB site/storage capacity show the following:

Schedule Comparison

	MMB in Capacity Development by Fiscal Year						
Source & Date	FY-84	FY-85	FY-86	FY-87	FY-88	FY-89	TOTAL
SOLUTION MINED SITE							
DOE - Mar 81	-	-	-	13	47	40	100
Accel Rpt - 81	-	-	1	24	75		100

	MMB in Capacity Development by Fiscal Year						
Source & Date	FY-84	FY-85	FY-86	FY-87	FY-88	FY-89	TOTAL
STEEL TANKS							
White Castle - 81	-	24	36	32	8		100
Corps Est - Mar 81	10	55	35				100
Corps Est - Jun 81	10	50	40				100
Accel Rpt - Jul 81	-	24	36	32	8		100

COST COMPARISON - $/BBL

SOURCE	YEAR ON WHICH $ BASED	30MMB	40MMB	100MMB	140MMB
SOLUTION MINED					
Turnkey	1980	---	---	6.72	5.25
Accel Rpt	1981	---	---	5.16	4.04
STEEL TANKS					
Turnkey	1980	6.97	6.43	---	---
White Castle	1980	8.50	8.00	---	---
Mar Corps Est	1981	7.71	7.59	7.23	---
Jun Corps Est	1981	8.25	8.13	7.71	---
Accel Rpt	1981	9.90	8.98	---	---

The Acceleration Report analysis for steel tanks appears to be based on what is referred to as White Castle in the above comparisons. This data was prepared - and withdrawn by the Corps in March 1981. This schedule did not represent an accelerated effort and produced excessive cost growth due to inflation factors.

DAEN-MPE
Honorable Carroll Hubbard

It was our understanding that there was a lack of capacity in the FY 84-86 time frame (See Acceleration Report, Page 1-3, Inclosure 1). Schedule and funding profiles were developed to meet this capacity shortfall. This info was provided to DOE in March to meet a June 1981 start, and in June to meet an October 1981 start date for the facility acquisition process. The Acceleration Report did not use either the March or June schedule for steel tanks which would provide the earliest fill period, the lowest construction cost by reducing cost growth due to escalation and, assuming oil was available, the savings on any price increases for oil. We do not know what costs are included in the Acceleration Report for the Big Hill solution mined site and therefore are unable to compare the lower 1981 cost predicted by the report.

Using a storage capacity of 100MMB, a comparison of the two storage alternatives is provided:

100MMB COMPARISON

COST	STEEL TANKS	SOLUTION MINED
Cost 81 $/BBL	8.25	5.16
Cost Current Year $	10.20	6.88
Fac Cost 81 $ (MM)	825	516
Oil Cost 81 $ (MM)	4,217	4,607
Fac Cost Current Year $ (MM)	1,020	712
Oil Cost Current Year $ (MM)	5,687	6,832
SCHEDULE		
Initial Capacity Available	FY-84	FY-86
Initial Amount Available	10MMB	1MMB
Complete Capacity Available	FY-86	FY-88

The above comparisons show the following:

a. Combined acquisition expenditure costs for facilities and oil is less in steel tanks.

b. Steel tanks additionally represent a two year schedule improvement over solution mined sites.

Further cost point consideration would be merited for uncertainties removed by use of the steel tank construction, as follows:

a. Programmatic risk reduced through schedule acceleration.

b. One hundred percent oil recovery in steel tanks versus unknown recovery loss in solution-mined sites. DOE admits to a 1.5% recovery loss. A 5% loss is regarded as more realistic based upon the many unknowns inherent in long-term storage in solution-mined cavities.

c. Regional storage location flexibility.

d. Storage vessels suitable for crude and product storage.

The information available supports the contention that storage by the solution-mined process may not be the most cost effective. There may be factors other than schedule and acquisition costs affecting the decision process which are not available to the Corps. It is suggested that the DOE be contacted for appropriate comments on the above.

If we may be of further assistance to you in responding to Mr. Albertson's inquiry, please advise.

Sincerely,

1 Incl
As stated

JEROME B. HILMES
Brigadier General, USA
Deputy Director for Facilities
Engineering and Housing
Directorate of Military Programs

estimates for Phase II in this paper are predicated on approval of this permit modification.

Phase III, in the FY 1982 budget, was planned to include the following elements:

- Further expansion of Bryan Mound by 40 MMB.
- Further expansion of West Hackberry by 30 MMB.
- Development of a new 140 MMB "grass roots" solution-mined site.

Because of the aforementioned increase in the brine disposal rate at Bryan Mound, the Phase III expansion of Bryan Mound will be cost-effective and timely in relation to the Phase III expansion of West Hackberry. Therefore, for purposes of this review, we have assumed a "Base Module" of 580 MMB, which will remain unchanged throughout the analysis. The base system consists of the following elements:

	(MMB)
Phase I	250
Phase II	290
Phase III Bryan Mound	40
Base System Total	580

Table I compares this Base Module to the FY 1982 budget baseline estimates for the oil fill capability schedule for the 750 MMB system. It illustrates the significant fill capability gains that can be achieved through 1986 through the revisions in the Bryan Mound brine disposal rate. Some of these gains are also attributable to the deletion of West Hackberry Phase III which, in the FY 1982 baseline, was proposed for development simultaneously (termed coexpansion) with West Hackberry Phase II. The coexpansion of West Hackberry Phases II and III actually results in a temporary retardation of Phase II fill capability in the 1984-1986 period.

The 580 MMB Base Module is held constant throughout the analysis with increments of storage development added thereto.

FACT SHEET

5 October 1981

SUBJECT: Above Ground Storage Facilities for Strategic Petroleum Reserve

PURPOSE:

This is to provide basis for response to Congressional inquiries regarding correspondence from Mr. A. A. Albertson, Vice President, CBI Industries, Inc. in connection with steel tank storage facilities for the Strategic Petroluem Reserve. These Congressional inquiries have centered around information which the Corps of Engineers may have provided to DOE.

BACKGROUND

The Corps provides DOE with professional management and technical services in support of the development of the Strategic Petroleum Reserve under a Master Interagency Agreement (MIA dated March 1979). The primary role of the Corps as delineated in the MIA is to manage the design and construction of the SPR's expansion from Phase II to the 750MMB total for Phase III. Under this agreement we participated in the Source Evaluation Board for the competitive turnkey solicitation which was intended to meet the Phase III requirements; conducted planning studies for the Regional Reserve; and developed cost and schedule data for above ground storage facilities. Above ground storage cost and schedule estimates were provided to DOE for use in their study of alternatives for accelerating storage facilities development.

FACTS

The information provided to DOE for above ground storage was as follows:

SCHEDULE

Source	MMB in Capacity Development by Fiscal Year FY-84	FY-85	FY-86	FY-87	FY-88	FY-89	TOTAL
White Castle - 81	-	24	36	32	8		100
Corps Est - Mar 81	10	55	35				100
Corps Est - Jun 81	10	50	40				100

COST - $/BBL

SOURCE	YEAR ON WHICH $ BASED	30MMB	40MMB	100MMB
White Castle	1980	8.50	8.00	---
Mar Corps Est	1981	7.71	7.59	7.23
Jun Corps Est	1981	8.25	8.13	7.71

5 October 1981

The information referred to as White Castle in the above tables was prepared and withdrawn by the Corps in March 1981. This schedule did not represent an accelerated effort and produced excessive cost growth due to inflation factors.

The Corps was requested to respond to a situation which indicated a lack of capacity in the FY 84-86 time frame. Schedule and funding profiles were developed to meet this capacity shortfall. This information was provided to DOE in March to meet a June 1981 start, and revised in June to meet an October 1981 start date for the facility acquisition process.

DISCUSSION

The information and cost comparisons contained in Mr. Albertson's inquiry have been evaluated at the request of Congressional Staffers. In order to fully evaluate the data, we obtained from DOE the Acceleration Report, dated July 1981 and analyzed it along with other data we have received or developed in support of DOE. Comparisons of the various schedules and cost data show the following:

SCHEDULE COMPARISON

	MMB in Capacity Development by Fiscal Year						
Source	FY-84	FY-85	FY-86	FY-87	FY-88	FY-89	TOTAL
SOLUTION MINED SITE							
DOE - Mar 81	-	-	-	13	47	40	100
Accel Rpt - 81	-	-	1	24	75		100
Accel Rpt - 81	-	-	-	13	47	80	140

	MMB in Capacity Development by Fiscal Year						
Source	FY-84	FY-85	FY-86	FY-87	FY-88	FY-89	TOTAL
STEEL TANKS							
White Castle - 81	-	24	36	32	8		100
Corps Est - Mar 81	10	55	35				100
Corps Est - Jun 81	10	50	40				100
Accel Rpt - Jul 81	-	24	36	32	8		100

5 October 1981

COST COMPARISON - $/BBL

SOURCE	YEAR ON WHICH $ BASED	30MMB	40MMB	100MMB	140MMB
SOLUTION MINED					
Turnkey	1980	---	---	6.72	5.25
Accel Rpt	1981	---	---	5.16	4.04
STEEL TANKS					
Turnkey	1980	6.97	6.43	---	---
White Castle	1980	8.50	8.00	---	---
Mar Corps Est	1981	7.71	7.59	7.23	---
Jun Corps Est	1981	8.25	8.13	7.71	---
Accel Rpt	1981	9.90	8.98	---	---

The Acceleration Report did not use either the March or June schedule for steel tanks which would provide the earliest fill period, the lowest construction cost by reducing cost growth due to escalation and, assuming oil was available, the savings on any price increases for oil. We do not know what costs are included in the Acceleration Report for the Big Hill solution mined site and therefore are unable to compare the lower 1981 cost predicted by the report.

A comparison of the two storage alternatives for 100MMB is provided:

100MMB COMPARISON

COST	STEEL TANKS	SOLUTION MINED
Cost 81 $/BBL	8.25	5.16
Cost Current Year $	10.20	6.88
Fac Cost 81 $ (MM)	825	516
Oil Cost 81 $ (MM)	4,217	4,607
Fac Cost Current Year $ (MM)	1,020	712
Oil Cost Current Year $ (MM)	5,687	6,832

5 October 1981

SCHEDULE	STEEL TANKS	SOLUTION MINED
Initial Capacity Available	FY-84	FY-86
Initial Amount Available	10MMB	1MMB
Complete Capacity Available	FY-86	FY-88

The above comparisons show the following:

a. Combined acquisition expenditure costs for facilities and oil is less in steel tanks.

b. Steel tanks additionally represent a two year schedule improvement over solution mined sites.

Further cost point consideration would be merited for uncertainties removed by use of surface tank construction, as follows:

a. Programmatic risk reduced through schedule acceleration.

b. One hundred percent oil recovery in steel tanks versus unknown recovery loss in solution-mined sites. DOE designs to a 1.5% recovery loss. A larger loss is regarded as more realistic based upon the many unknowns inherent in long-term storage in solution-mined cavities.

c. Regional storage location flexibility.

d. Storage vessels suitable for crude and product storage.

J. Vincent/272-0795

FACT SHEET 19 October 1981

SUBJECT: Above Ground Storage Facilities for Strategic Petroleum Reserve

PURPOSE

This fact sheet is a supplement to the 5 October 1981 fact sheet subject as above. This fact sheet provides a comparison of a 140MMB storage in solution mined and above ground storage sites.

FACTS

This comparison uses solution mined data for the Big Hill site found in the DOE Acceleration Report dated July 1981 and the June 1981 Corps estimate for above ground storage expanded from 100MMB to 140MMB.

140MMB COMPARISON

COST	STEEL TANKS	SOLUTION MINED
Cost 81 $/BBL	7.23	4.04
Cost Current Year $	9.90	5.71
Fac Cost 81 $ (MM)	1,012	566
Oil Cost 81 $ (MM)	5,942	6,593
Fac Cost Current Year $ (MM)	1,387	799
Oil Cost Current Year $ (MM)	7,752	10,107
SCHEDULE		
Initial Capacity Available	FY-84	FY-87
Initial Amount Available	30MMB	13MMB
Complete Capacity Available	FY-86	FY-89

J. Vincent/272-0397

SECTION 4

STRATEGIC PETROLEUM RESERVE ACCELERATION REPORT TO THE SECRETARY

EXECUTIVE SUMMARY AND CONCLUSIONS

SUMMARY

The purpose of this Report is to provide information for use by the Department of Energy and the Executive Office of the President for deciding on changes to the development plan for the Strategic Petroleum Reserve (SPR) presented in the March 10, 1981 President's Budget for 1982. This Report is intended to support the needs for the FY 1983 Planning, Programming and Budgeting process and to satisfy a request by the Office of Management and Budget of March 24, 1981 for a study by August 1 "of all alternatives for accelerating the facilities development schedule so as to increase U.S. protection against supply interruptions in the near term."

The prior Administration had approved completion of a 750 MMB government-owned, centralized crude oil storage program in 1989 with 420 MMB in storage capacity available by the end of calendar year 1985. Under this plan the development of the Reserve would take place in three phases: Phase I, consisting of a 250 MMB storage capacity, Phase II, consisting of a 290 MMB storage capacity, and Phase III encompassing a remaining 210 MMB storage capacity.

Phase I has been completed. Moreover, over 75 percent of the $702 million appropriated for Phase II has already been obligated. As a consequence, this part of SPR development is treated as a given, being included on all the alternatives considered.

Phase III development is scheduled to commence in FY 1982. One element of the Phase III plan--the 40 MMB expansion of Bryan Mound--was considered as given because of the clear cost-effectiveness of this expansion. The other two Phase III elements--the 30 MMB expansion of West Hackberry and the development of a new 140 MMB site at Big Hill--were not considered as given. Rather, they were evaluated along with other facilities development options.

In light of these above considerations, a 580 MMB base module consisting of Phase I (250 MMB), Phase II (290 MMB), and Phase III, (Bryan Mound) (40 MMB), was developed. Beyond this 580 MMB base module, additional incremental modules were evaluated. These additional incremental modules are summarized in the following table:

Summary of Incremental Modules

Increment	Size (MMB)
(1) West Hackberry, Phase III	
a. Coexpansion with Phase II	30
b. Deferred expansion	30
(2) Big Hill	
a. 100 MMB	100
b. 140 MMB	140
(3) New Solution-Mined Site	120
(4) Cote Blanche	40
(5) Steel Tanks	
a. 40 MMB (FY 82 Budget)	40
b. 30 MMB (FY 83 Budget)	30

Costs per barrel for each of these increments were compared in terms of budget and real dollars and present value terms. The above increments were also evaluated according to several measures that consider both costs (facility and oil costs) and benefits represented as either incremental capacity added annually or cumulative barrels of capacity at the end of each year.

The development schedules utilized for the study are based on the maximum development rate deemed technically feasible. The possibility of accelerating development by such measures as waiver of Federal environmental and procurement requirements and accelerating the procurement process was also examined. For the existing planned development, much of environmental and procurement work has been accomplished and therefore not at issue. For new development, it is not presently foreseeable that these requirements will be constraining in most cases. Thus, we can not at this time identify quantifiable gains which would be achieved through measures of this kind. However, it should be recognized that delays in schedules utilized for this study can result from environmental, procurement, or other problems and relief then may become necessary in order to maintain the schedules.

The criteria used for ranking these individual increments to the 580 MMB Base Module were as follows:

- minimization of the unit cost of facilities in nominal dollars, real dollars, and the present value of real dollars;
- minimization of real dollar program (oil plus facilities) cost per-barrel;
- maximization of the ratio of discounted facility capacity increments to present value of facilities costs, for all discount rates; and
- maximization of the ratios of discounted barrel-years of protection to total program investment value (present value of facilities and oil costs net of salvage value) up to, and including, benefit discount rates of 10 percent per year.

After the individual increments were ranked, five SPR systems alternatives were developed for further evaluation.

(1) a 750 MMB system--consisting of the Base Module (580 MMB); plus the 30 MMB coexpansion of West Hackberry; plus the development of 140 MMB capacity at Big Hill.

(2) a 790 MMB system--consisting of the above-mentioned 750 MMB system; plus Cote Blanche (40 MMB).

(3) an 890 MMB system--consisting of the above-mentioned 790 MMB system; plus 100 MMB of steel tanks.

(4) a 1,000 MMB system--consisting of the above-mentioned 890 system; plus a new 110 MMB solution-mined site.

(5) a 1,000 MMB system--consisting of the 890 MMB system defined in (3); plus 110 MMB of steel tanks.

These five SPR systems were evaluated in terms of their net benefit stemming from an oil supply shortfall. A computerized decision model--

developed for the Policy, Planning, and Analysis Office of the department by Professor Tom Teisberg, of MIT--was used to estimate these economic loss reductions.

The Teisberg model evaluated each of the SPR system alternatives in terms of net economic benefit implicit at various statistical assumed probabilities for an oil supply interruption occurring during the lifespan of the SPR project. The results of this evaluation are ranked ordinally in the table below with the alternative system expressing the largest net economic benefit being ranked number one.

Rank Ordering of the Results of the Teisberg Model Analysis
According to Size of Consumer Surplus Loss Avoided

Assumed Probability of Oil Supply Shortfall		System Project Alternatives				
Yearly	Project Life[1]	(1) 750	(2) 790	(3) 890	(4) 1,000	(5) 1,000
				(tight market)[2]		
0.0.	.0.0	N/A	N/A	N/A	N/A	N/A
1.0.	.21	1	2	3	4	5
2.0.	.38	1	2	3	4	5
3.0.	.48	4	2	1	3	5
4.0.	.62	5	4	3	1	2
5.0.	.71	5	4	3	2	1
10.0.	.92	5	4	3	2	1
15.0.	.98	5	4	3	2	1
20.0.	.99+	5	4	3	2	1
				(slack market)		
5.0.	.71	5	4	3	2	1
10.0.	.92	5	4	3	2	1
15.0.	.98	5	4	3	2	1
20.0.	.99+	5	4	3	2	1

[1] Project life of 24 years running from 1981 to 2004 inclusive; expresses the statistical chance of encountering at least one such oil supply shortfall.

[2] The terms "slack" and "tight" refer to alternative market conditions when SPR oil is being purchased. Under a slack market, such as at the present, SPR oil purchases do not increase market prices and thereby affect the cost to the U.S. economy or private sector oil imports. Under tight market conditions, SPR purchases do increase market prices and therefore represent a conservative assumption regarding the net economic benefits of various SPR system configurations

The above results indicate that increases in the assumed probability of a shortfall justify progressively greater SPR sizes.

CONCLUSIONS

This study yields the following conclusions:

(1) the 750 MMB program contained in the FY 82 budget cannot be further accelerated to any significant degree and its composition is the most cost-effective 750 MMB system.

(2) under most circumstances, Cote Blanche is the most attractive increment to the existing elements of the current 750 MMB system for expansion to 790 MMB.

(3) beyond a 790 MMB system, if protection against an oil supply interruption during the 1980's is sought, then steel tanks are preferred. However, if the protection desired extends through the entire century, then a new solution-mined site is more cost-effective.

(4) 1,000 MMB SPR is economically justified if the expected probability of an oil supply cut-off is at least 4 percent per year (implying a 62 percent likelihood of at least one such occurrence over the 24-year lifespan of the SPR project).

(5) then 790 MMB and 890 MMB systems are economically justified if the expected probability of an oil supply cut-off is at least 3 percent per year (implying a 48-percent probability of at least one shortfall during the project life).

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SECTION I

INTRODUCTION

PURPOSE OF THE REPORT

This Report was prepared for use by the Department of Energy and the Executive Office of the President in making decisions on whether to change the plan for Strategic Petroleum Reserve (SPR) development which was embodied in the March 10, 1981 President's Budget for FY 1982. It is intended to satisfy the needs of Department of Energy decision makers for the FY 1983 Planning, Programming, and Budgeting process and to satisfy the request of the Office of Management and Budget of March 24, 1981 to "prepare a study, by August 1, of alternatives for accelerating the facilities development schedule so as to increase U.S. protection against supply interruptions in the near term."

APPROACH TO THE PROBLEM

The current Administration inherited from the prior Administration a Strategic Petroleum Reserve (SPR) facilities development plan which would result in completion of a 750 MMB government-owned, centralized crude oil storage program in 1989, with 420 MMB in storage capacity available by the end of calendar year 1985. The Energy Policy and Conservation Act of 1975 had set a minimum target of 500 MMB in storage by the end of 1982, and the Carter Administration had, in the 1977 National Energy Plan and in SPR Plan Amendment No. 2, set a goal of 1 billion barrels in storage by 1985, and described a plan for a 750 MMB government-owned system to be completed by that year.

The reasons for the delays of prior years will not be discussed at length in this paper. Rather, we will focus on the remaining options available in 1981 for future decisions to alter the SPR development program.

The SPR program as set forth in the FY 1982 budget is being developed in three Phases. Phase I involved the conversion for hydrocarbon storage of existing salt caverns at five storage sites, plus the development of transportation facilities to connect the storage sites to major elements of the U.S. crude oil distribution system. In the FY 1982 budget, the capacity of Phase I was set at 248 MMB; in this report, due to more recent analysis, the Phase I capacity is rated at 250 MMB.

Phase I storage site development is complete and available for fill during the FY 1981-2 period, though limited facilities funding actions continue as the courts render judgment on the real-estate condemnation cases. Physically, Phase I capacity and schedule are considered as given for purposes of this review.

Phase II consists of a further 290 MMB in capacity developed at three of the Phase I storage sites: West Hackberry (160 MMB), Bryan Mound (120 MMB) and Bayou Choctow (10 MMB). Generally, Phase II expansions are being carried out through solution-mining (leaching) new storage capacity, involving the drilling of wells into the salt formation, the development of fresh water intake capabilities to inject fresh water into the salt, and the disposal of saturated brine. Of the $702 million estimated cost to complete Phase II, over 75 percent or $527 million has already been appropriated and will be obligated by the end of FY 1981. Surface facilities development is nearing completion and leaching has commenced at both Bryan Mound (in 1980) and West Hackberry (in 1981).

Given the sunk costs and progress to date on Phase II, this study does not consider alternatives for major changes to the basic plan for the configuration of Phase II. However, one opportunity for acceleration of a portion of Phase II has been identified. Since the brine disposal pipeline at Bryan Mound was designed for a higher flow rate then allowed by the current EPA discharge permit, the Department of Energy, in February, 1981, applied for a change in the permit to allow brine discharge into the Gulf of Mexico at a daily average rate of 980 MBD, in comparison to the current permitted rate of a maximum of 680 MBD on each day. Assuming approval of this application, the change in the terms of this permit plus the addition of some pumps late in 1981 will accelerate the completion of the Bryan Mound Phase II and, as discussed below, Phase III capacity. The revised schedule estimates for Phase II in this paper are predicated on approval of this permit modification.

Phase III, in the FY 1982 budget, was planned to include the following elements:

- Further expansion of Bryan Mound by 40 MMB.
- Further expansion of West Hackberry by 30 MMB.
- Development of a new 140 MMB "grass roots" solution-mined site.

Because of the aforementioned increase in the brine disposal rate at Bryan Mound, the Phase III expansion of Bryan Mound will be cost-effective and timely in relation to the Phase III expansion of West Hackberry. Therefore, for purposes of this review, we have assumed a "Base Module" of 580 MMB, which will remain unchanged throughout the analysis. The base system consists of the following elements:

	(MMB)
Phase I	250
Phase II	290
Phase III Bryan Mound	40
Base System Total	580

Table I compares this Base Module to the FY 1982 budget baseline estimates for the oil fill capability schedule for the 750 MMB system. It illustrates the significant fill capability gains that can be achieved through 1986 through the revisions in the Bryan Mound brine disposal rate. Some of these gains are also attributable to the deletion of West Hackberry Phase III which, in the FY 1982 baseline, was proposed for development simultaneously (termed coexpansion) with West Hackberry Phase II. The coexpansion of West Hackberry Phases II and III actually results in a temporary retardation of Phase II fill capability in the 1984-1986 period.

The 580 MMB Base Module is held constant throughout the analysis with increments of storage development added thereto.

Table I.1 Strategic Petroleum Reserve Fill Capability

Comparison of the FY 1982 Baseline to the Base Module
(Cumulative MMB, End of Fiscal Year)

	1981	1982	1983	1984	1985	1986	1987	1988	1989
FY 1982									
(a.) Baseline									
Phase I	248	248	248	248	248	248	248	248	248
Phase II	---	13	83	151	157	203	274	290	290
Phase II	---	---	---		4	30	83	149	212
Total	248	261	331	398	409	481	605	687	750
(b.) Base Module									
Phase I	250	250	250	250	250	250	250	250	250
Phase II	1	17	93	166	205	273	290	290	290
Phase III (BM)	---	---		1	12	40	40	40	40
Total	251	267	343	417	467	563	580	580	580
Percent/ (a) to (b)	0.99	0.98	0.97	0.95	0.88	0.55	1.04	1.18	1.29

Section II, backed up by the Appendix A, defines the alternative increments to the 580 MMB Base Module and presents the budget and fill schedule data associated with each.

Section III is an analysis of each alternative increment based on various evaluation measures. These measures compare benefits, represented by either annual or cumulative fill capability, to the present value of cost of facilities or facilities and oil. This is not a net economic benefits analysis because the costs and benefits are not presented in commensurable terms. Rather, Section III attempts to rank alternatives in terms of the relationship of the fill capability schedule to the present value of costs.

Section IV presents some overall system configuration alternatives combining the 580 MMB Base Module with the alternative facilities increments ranked in Section III.

Section V uses the Teisburg model to compare the net economic benefits of the alternative system configurations presented in Section IV.

SECTION II

DESCRIPTION OF ALTERNATIVE INCREMENTS TO THE BASE MODULE

OVERVIEW

This section describes the alternative SPR storage facility increments that could be added to the Base Module described in Section I.

The early (1974-75) National Petroleum Council Studies recommended that the SPR stockpile be stored in large salt caverns in the Gulf Coast area, and SPR planning by the Federal Energy Administration led to the identification of numerous salt dome formations along the Gulf Coast. The current 750 MMB SPR configuration is the result of a process of elimination among candidate salt domes using a specific set of criteria, among which facilities development cost emerged as a priority determinant in site selection.

From time to time during this process, there has been interest in finding alternative sites and/or storage media that would enhance the SPR schedule. In 1978 a rigorous process was initiated to obtain and evaluate industry offers to develop SPR storage facilties on a "turnkey" basis. This "turnkey" procurement was cancelled in 1979, basically because the curtailment of SPR oil fill by the Carter Administration made it unclear that it was worth spending money to accelerate facility capacity due to the potential that the facilities would be left temporarily unfilled, and because the "turnkey" proposals seemed to lack advantages over conventional site development.

Other proposals for alternative SPR facilities have been raised from time to time, including the use of conventional above-ground steel tanks, the leasing of storage capacity from the private sector, and the use of oil tankers for floating storage, a method employed by the Japanese government.

The government's procurement, environmental, and budget processes are such that there is a considerable delay from the time a concept is articulated to the time a funded construction project is underway. In addition to the passage of time for these processes to run their course, new uncertainties emerge about the basic viabilty of a new or different concept, just as the oil acquisition curtailment introduced new uncertainties into the SPR competitive turnkey procurement process.

Therefore, while not completely disregarding the possibility that there may, in fact, be some low-cost attractive schedule facilities alternatives "out there", we have confined our analysis to facilities options about which enough is known to permit decision making in 1981 with a relatively high degree of confidence. Specifically, we have looked at alternative configurations of development for the SPR projects that are within the 750 MMB FY 1982 baseline system but outside the 580 MMB base module. In addition, we have revisited the possibility, first raised about 5 years ago, of converting the Cote Blanche salt mine for oil storage. Finally, in part with the assistance of the Corps of Engineers, we have developed cost and schedule prototypes of two known methods of oil storage--development of another large underground salt dome site through solution-mining and development of some large but technically conventional steel tank storage sites.

The schedules for each increment are based on the maximum development rate deemed technically feasible. As mentioned previously, leaching rates, one of the principal determinants of schedule, are being accelerated to the full capability of brine disposal systems currently developed.

We have also reviewed the possibility of accelerating development of each alternative increment by administratively or legislatively waiving existing environmental, permitting, land acquisition and procurement requirements. However, while such factors could prove constraining, we presently can not quantify significant acceleration from such action for these reasons:

(1) A large number of these requirements on existing planned development will be satisfied by the end of FY 81.

(2) An environmental impact statement has already been prepared for Cote Blanche, a former "turnkey site", for 30 MMB. Only a supplemental to the existing EIS would be required for the 40 MMB site.

(3) New developments such as steel tanks and a new solution-mined site will not benefit from waiving requirements in these areas because they are not on the critical path or because so far as currently can be determined they are already at the maximum feasibile rate of development.

A more detailed assessment of the effect on the development schedule for each alternative increment of complying with existing requirements in these areas and the scheduling assumptions used are presented in Appendix B.

Not withstanding the above comments, waivers of environmental requirements could become desirable if any major impediments to acquiring approval to proceed with a given development should occur. However, such contingencies would apply across all alternatives and would be addressed on a case-by-case basis.

None of these alternatives is risk-free, but we have tried to build in reasonable contingency factors in cost and schedule estimates. The following is a brief description of each of these alternatives.

(1) FURTHER EXPANSION OF WEST HACKBERRY

West Hackberry is the largest planned SPR site; it now has a Phase I capacity of 48 MMB and is planned for expansion by 160 MMB as part of Phase II. Phase II leaching actually commenced in May 1981, the surface construction having been substantially completed during 1980 and early 1981. Adding three new caverns (30 MMB) to this site in Phase III, as planned in the 1982 budget, is a relatively straightforward matter of drilling additional wells, developing tie-ins to other site piping, electrical, and instrumentation systems, and using existing fresh water intake, brine disposal, and crude oil transportation infrastructure to complete the leach fill process.

Two expansion subalternatives have been identified:

(a) Coexpansion: This involves leaching the three Phase III caverns in tandem with the second group of Phase II caverns, resulting in operational efficiencies but retarding Phase II cavern development.

(b) Deferred leaching: This involves waiting for the Phase II caverns to be completed before leaching the Phase III caverns.

This decision does not have to be made until 1983, but we have used both subalternatives in the evaluation to permit a fair comparison of the West Hackberry increment to other alternatives.

(2) BIG HILL

The Big Hill salt dome was identified as a candidate SPR site very early in the SPR planning process. In the FY 1982 budget, it is proposed for development to a 140 MMB size as part of Phase III. Considerable environmental analyses have been completed on Big Hill, and a process has been established for selecting an architect/engineer. However, major capital commitments, such as land acquisition, have not yet been made so Big Hill was not included in the 580 MMB Base Module.

As with West Hackberry, two subalternatives have been identified for Big Hill.

(a) 100 MMB: This involves the development of only 10 caverns at Big Hill, without a change in the overall site brine disposal capabilities, permitting the average cavern to develop at a faster rate. However, since the infrastructure is about the same as for the 140 MMB size, the unit costs of developing a 100 MMB size tend to be higher.

(b) 140 MMB: This is the proposal in the FY 1982 budget.

We have not evaluated a reconfiguration of the 140 MMB project, which would entail leaching the first 100 MMB at a faster rate as in subalternative (a), deferring leaching of the other 40 MMB. The decision would not need to be made for several years. The availability of the FY 1982 budget funding requested for Big Hill is assumed for both cases.

(3) NEW SOLUTION-MINED SITE

This entails the development of a new solution-mined SPR facility, beginning in FY 1983, to the level of 120 MMB, at a site which has not been identified and where no site-specific cost, design schedule, or environmental analyses have been conducted.

(4) COTE BLANCHE MINE

This is the conversion to hydrocarbon storage of the Cote Blanche mine, a conventional salt mine near the existing SPR Weeks Island site in southern Louisiana.

Cote Blanche is an operating salt mine that had been identified some years ago and considered for SPR use. The owners and operators were contacted at that time and some negotiations were conducted until late 1979. The fact that the property is owned by two family trusts which have been unwilling to sell, and that the operator's lease rights are limited, made it very difficult to negotiate a satisfactory acquisition. Condemnation of the site could prove necessary and it would be difficult to assure continued salt mining operations elsewhere by the current operator. Unemployment and lost salt production could result, and the operator, a Canadian company, previously threatened diplomatic repercussions. Also, the taking of this site could be alleged to violate a February, 1978 "best efforts" agreement between former DOE Deputy Secretary O'Leary and Louisiana's then--Governor Edwards that "DOE use of . . . salt Dome(s) . . . will be acceptable to the State, so long as no employees of industries utilizing the Domes are displaced in their jobs."

Some years ago, Cote Blanche was thought to have a capacity of over 30 MMB, but we have estimated the future capacity at 40 MMB, based on continued mining in the interim.

(5) STEEL TANKS

Working with the Corps of Engineers, we have developed prototype cost and schedule estimates for both a 40 MMB and a 30 MMB steel tank storage site. In both cases we assume the use of large (1.25 MMB) steel tanks developed in 5 MMB modules in series. The first module on a site thus becomes available for fill while subsequent modules are being developed.

For the 40 MMB module we are assuming nearly full-funding in FY 1982 to be followed by funding for the 30 MMB module in FY 1983. Changes in funding and schedule for both are possible, and further increments can be added to this 70 MMB to achieve higher levels. However, while site selection activities have not been undertaken, one could assume that each incremental site required to achieve higher total storage levels would involve greater cost/schedule/environmental trade-offs. A 40 MMB steel tank storage site, although much smaller than the average SPR Base Module site, is a visibly large government development activity.

Table II.1 sets forth the oil fill capability schedule for each increment to the Base Module. Table II.2 sets forth the facilities development budget requirements for each, and Table II.3 sets forth the ultimate oil budget costs of each. Oil acquisition budget authority and outlay timing has not been estimated for separate modules, but has been addressed in the evaluation of alternative SPR systems.

Table II.1 Strategic Petroleum Reserve Fill Capability

Base Module and Effects of Alternative Facility Increments

Cumulative MMB, End of Fiscal Year

Increment (Yr of Initial Funding)	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Base Module	251	267	343	417	467	563	580	580	580	580
(1) West Hackberry Expansion										
COEXPANSION (FY 82)	-	-	-	-	-11	-25	+18	+30	+30	+30
DEFERRED (FY 84)	-	-	-	-	-	-	1	14	30	30
(2) Big Hill										
100 MMB (FY 82)	-	-	-	-	-	1	25	100	100	100
140 MMB (FY 82)	-	-	-	-	-	-	13	60	140	140
(3) New Solution Mined-Site (FY 83)	-	-	-	-	-	-	-	14	60	120
(4) Cote Blanche (FY 82)	-	-	-	18	40	40	40	40	40	40
(5) Steel Tanks										
40 MMB (FY 82)	-	-	-	-	8	20	32	40	40	40
30 MMB (FY 83)	-	-	-	-	8	20	30	30	30	30

Table II.2 Strategic Petroleum Reserve Facilities Development and Operations Budget
Base Module and Effects of Alternative Facilities Increment
(In Millions of Dollars)

		Prior Years	FY 1982	FY 1983	FY 1984	FY 1985	Fy 1986	FY 1987	FY 1988	Future	Total
Base Module											
	BA	1477	94	161	147	136	108	82	-	-	2205
	BO	1307	154	219	148	120	139	110	8	-	2205
(1) West Hackberry Expansion											
Coexpansion	BA	1	3	34	13	13	15	17	-	-	96
	BO		2	21	22	13	1	24	10	3	96
Deferred	BA				9	35	16	38	42	22	162
	BO				2	25	27	43	39	26	162
(2) Big Hill											
100 MMB	BA	1	81	355	78	64	42	40	51	-	712
	BO		47	175	195	130	58	41	54	12	712
140 MMB	BA	1	81	390	78	64	42	40	50	53	799
	BO		47	184	221	130	58	41	56	62	799
(3) New Solution-Mined Site											
	BA			66	145	397	202	60	66	113	1049
	BO			55	131	355	236	84	65	123	1049
(4) Cote Blanche											
	BA		213	4	7						224
	BO		54	106	61	3					224
(5) Steel Tanks											
40 MMB	BA	6	496		1	2	3	5	5		518
	BO		38	58	105	117	104	60	36		518
30 MMB	BA	6	29	388	1	2	3	4			433
	BO		35	1	104	135	86	72			433

Table II.3. Strategic Petroleum Reserve Oil Costs
(nominal[1] dollars in millions)

	MMB	COSTS
Base Module	580	25,037[2]
West Hackberry		
Coexpansion	30	2,164
Deferred	30	2,169
Big Hill		
100 MMB	100	6,833
140 MMB	140	10,107
New Solution-Mined Site	120	9,223
Cote Blanche	40	2,141
Steel Tanks		
40 MMB	40	2,497
30 MMB	30	1,811

[1] Using price assumptions from the March 10, 1981 President's Budget revisions.

[2] Reflects deduction of the entitlements benefits through July, 1980 (ESA passage), but includes full cost of oil after July, 1980 ($542 million benefit not deducted).

SECTION III

EVALUATION OF ALTERNATIVE INCREMENTS TO THE BASE MODULE

APPROACH

The purpose of this section is to evaluate the alternative facility development increments from the standpoint of both cost and schedule, to identify logical rankings of increments as the basis for identifying SPR configuration/size alternatives in Section IV.

There are a number of different criteria that one could apply to the ranking of alternative increments. Not all criteria result in the same rankings as will be illustrated in this section. Rather than argue for one particular ranking method, we have chosen to employ multiple methods to discover whether there are some logically least and most preferrable alternatives on a weight-of-the-evidence basis.

MINIMIZATION OF THE COST OF FACILITIES

Under this approach, one seeks to minimize the cost of SPR facilities on a per-barrel basis, independent of trends in oil prices and decisions on SPR oil acquisition. This analysis is also independent of schedule except to the degree that the present value of facilities costs is affected by the timing of financial outlays.

Table III.1 presents the per-barrel costs of each facilities increment in budget (escalated) dollars, real 1981 dollars, and the present value in 1981 of the real dollar cost stream, using a 10 percent discount rate.

Table III.1 Per-Barrel Cost Analysis

	INCREMENT	MMB	BUDGET COSTS/BBL			REAL COST/BBL (1981 DOLLARS)			PRESENT VALUE IN 1981 OF REAL COST/BBL		
			FACILITIES	OIL	TOTAL	FACILITIES	OIL	TOTAL	FACILITIES	OIL	TOTAL
	Base Module	500	$ 3.80	$43.17	$46.97	$3.83	$34.54	$38.38	$4.10	$29.04	$33.15
(1)	West Hackberry Expansion										
	Coexpansion	30	$ 3.20	$72.13	$75.33	$2.20	$47.17	$49.37	$1.53	$22.70	$24.23
	Deferred	30	$ 5.40	$72.30	$77.70	$3.07	$47.10	$50.17	$1.83	$23.03	$24.87
(2)	Big Hill										
	100 MMB	100	$ 7.12	$68.33	$75.45	$5.16	$46.07	$51.23	$3.80	$24.24	$28.04
	140 MMB	140	$ 5.71	$72.19	$77.90	$4.04	$47.09	$51.14	$2.96	$23.11	$26.06
(3)	New Solution-Mined Site	120	$ 8.74	$76.86	$85.60	$5.56	$48.36	$53.92	$3.63	$21.77	$25.40
(4)	Cote Blanche	40	$ 5.60	$53.52	$59.12	$4.62	$41.93	$46.55	$3.85	$29.90	$33.75
(5)	Steel Tanks										
	40 MMB (FY 82)	40	$12.95	$62.42	$75.38	$8.98	$44.43	$53.40	$6.35	$26.35	$32.70
	30 MMB (FY 83)	30	$14.43	$60.37	$74.80	$9.90	$43.87	$53.77	$6.93	$27.10	$34.03

The following conclusions can be drawn from Table III.1 in terms of the unit costs of facilities alone.

(1) Whether one is concerned with minimizing budget costs, real dollar costs, or present value of real dollar costs,

(a) Both West Hackberry expansion subalternatives are the cheapest form of facilities development, and

(b) Steel tank development costs are the most expensive.

(2) The development of Big Hill is cheaper than the development of a new solution-mined site except that the extended nature of the development of a new site reduces the present value of its cost stream below that of Big Hill 100.

(3) In terms of budget dollars, Cote Blanche is slightly cheaper than both Big Hill alternatives because it involves a faster spend-out, but in terms of real-dollar costs, Cote Blanche tends to fall between the Big Hill 140 and Big Hill 100 alternatives.

MINIMIZATION OF THE PER-BARREL COST OF FACILITIES AND OIL

Since oil acquisition will represent over 90 percent of the total costs of the SPR, it is logical to consider both facilities and oil costs in ranking configuration options. Table III.1 illustrates that alternatives with higher facilities costs can have lower overall budget costs, assuming that oil prices increase as projected in the March 10, 1981 President's budget.

(1) Cote Blanche becomes the least expensive alternative in terms of budget costs and real dollar costs on a per-barrel basis, even less costly than the West Hackberry expansion.

(2) In those same terms, steel tanks are less expensive than a new solution-mined site and competitive with Big Hill alternatives, because the oil would be acquired sooner.

(3) The Big Hill 100 MMB subalternative becomes more competitive with the 140 MMB subalternative.

(4) The use of the present value measure of cost substantially changes the rankings from those which result from use of nominal and real dollar measures. The more accelerated alternatives--Cote Blanche and steel tanks--become the most costly. The new solution-mined site, where fill is not complete until 1990, is one of the least expensive alternatives. The reason for these changes is that the oil price projections assume 3 percent annual real growth, while the real discount rate is set at 10 percent, the standard Federal benefit/cost analysis time preference criterion. Therefore, accelerated oil purchases actually increase the present value of oil costs.

It should be noted that per-barrel salvage values have not been netted out of the oil costs for this particular analysis. This does not affect relative rankings because the per-barrel oil salvage value would be the same for all alternatives.

Figure III-1 traces the relative rankings of the alternatives using the different per-barrel cost measures.

MAXIMIZATION OF THE RATIO OF FACILITY FILL CAPABILITY SCHEDULE TO THE PRESENT VALUE OF FACILITIES COSTS

As noted above, the introduction of the present value measure into the evaluation of total program costs tends to penalize the more accelerated alternatives without considering the benefits as well as costs of acceleration. To help correct for this problem, we have developed a ranking measure which is a ratio, expressed as a percentage, of the incremental barrels of storage capacity discounted at various rates to 1981 (present value of benefits) to the present value of facilities costs for each alternative.

The merits of this evaluation measure are that it addresses directly the benefits and costs of the near term investment decision being made on facilities development. It assumes nothing about oil cost trends or oil fill schedule but addresses how, by spending alternative amounts for facilities, one can affect the timing of fill capability.

FIGURE III.1: RANKINGS OF ALTERNATIVES BY PER BARREL COST USING ALTERNATIVE METHODS OF MEASUREMENT (#1ST IS LEAST EXPENSIVE)

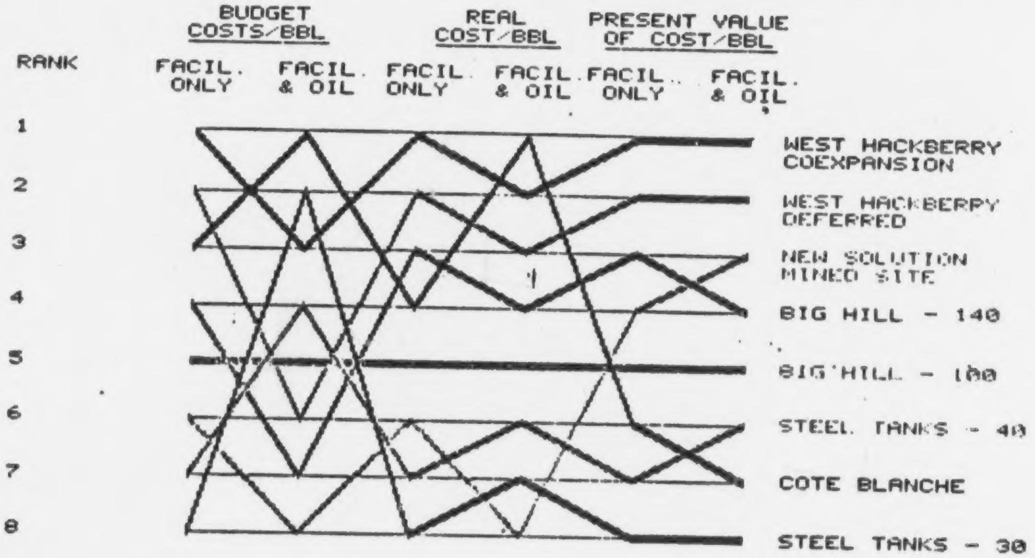


Table III.2 assesses the alternatives in terms of this measure for five different benefit discount rates. Costs remain discounted at 10 percent, irrespective of benefit discount rates. It should be noted that with a 0 percent benefit discount rate, the benefit of each alternative is rated as its total capacity irrespective of schedule. Thus the benefit/cost ratio is actually the inverse of the per-barrel present value cost of facilities, expressed as Table III.1. At higher benefit discount rates, the benefits of each alternative capacity decline below total capacity in accordance with the timing of development.

The following conclusions can be drawn from Table III.2 and Figure III.2, which illustrate these same phenomenon in graphic form.

(1) For all benefit discount rates, the West Hackberry expansion sub-alternatives remain the most cost-effective.

(2) Steel tanks are the least cost-effective in terms of this measure for all benefit time preferences, though with a strong (20 percent) preference for benefit acceleration, steel tanks become competitive to the development of a new solution-mined site.

(3) Cote Blanche is more cost-effective than either Big Hill 100 or Big Hill 140 with a 10 percent or higher benefit discount.

(4) Big Hill 140 remains relatively more cost effective than Big Hill 100 throughout all benefit discount rates.

MAXIMIZATION OF THE RATIO OF THE END-OF-YEAR FILL CAPABILITY SCHEDULE TO THE PRESENT VALUE OF FACILITIES AND OIL COSTS

We also computed a similar evaluation measure as the one above expressed as a ratio of the total cumulative storage capability discounted at various rates to 1981 to the present value of facilities and oil costs for each

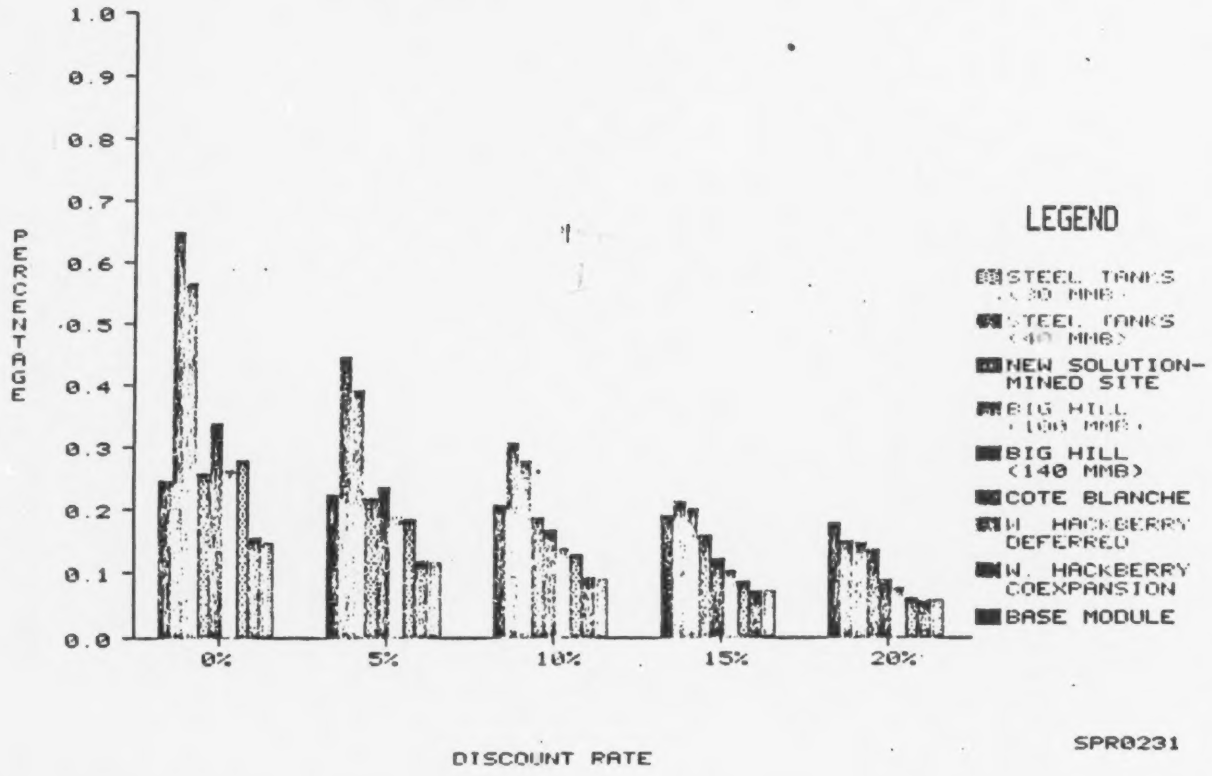
Table III.2. Ration of Time Preference (Discount) Rate on Incremental Capacity to Present Value of Facilities Cost

	Present Value (81) of Facilities Costs (Millions)		Discount Rate 0%	5%	10%	15%	20%
Base Module	$2,378	a[1]	580	527	484.8	450.6	422.6
		b[2]	.244	.221	.204	.189	.178
(1) West Hackberry Expansion							
Coexpansion	46	a	30.0	20.6	14.2	9.9	6.8
		b	.647	.444	.306	.212	.147
Deferred	55	a	30.0	20.8	14.7	10.5	7.7
		b	.566	.392	.277	.199	.145
(2) Big Hill							
100 MMB	380	a	100.0	72.0	52.7	39.1	29.4
		b	.261	.188	.137	.102	.076
140 MMB	414	a	140.0	97.3	68.8	49.4	36.1
		b	.338	.235	.166	.119	.087
(3) New Solution-Mined Site	436	a	120.0	79.8	54.1	37.4	26.2
		b	.276	.183	.124	.085	.060
(4) Cote Blanche	154	a	40.0	33.6	28.6	24.4	21.0
		b	.261	.220	.187	.159	.137
(5) Steel Tanks							
40 MMB (FY 82)	254	a	40.0	30.6	23.8	18.7	14.9
		b	.153	.117	.091	.071	.057
30 MMB (FY 83)	208	a	30.0	23.4	18.6	14.9	12.0
		b	.144	.113	.089	.071	.057

[1] Discounted barrels (MMB)

[2] Ratio of discounted barrels to present value of facilities cost

FIGURE III.2: RATIO OF TIME PREFERENCE (DISCOUNT) RATE ON INCREMENTAL CAPACITY TO PRESENT VALUE OF FACILITIES COST.



increment less the present worth of salvage value of the oil. Salvage values were computed based on full project life and half-project life.[1]

The merit of this measure is that it represents the "benefit" in each year as the cumulative fill (versus the incremental) which is available at the start of that year to offset economic losses due to an oil supply cutoff. Thus, it has the attribute of being a reasonable proxy of economic benefit. On the cost side it considers total systems costs less the value of the oil (recoverable costs) at the end of project life and thus it is a closer representation of total life cycle costs.

Tables III.3 and III.4 and Figures III.3 and III.4 present the above ratio for each incremental alternative examined for five different benefit discount rates for full project life and half-project life, respectively. As with the previous ratio, costs remain discounted at 10 percent irrespective of benefit discount rates.

As expected, ratios computed on the basis of half-project life indicated more preference for faster alternatives whereas ratios computed at full project life require more discounting of benefits to justify higher cost systems.

On the basis of the values of this evaluation measure, the following conclusions can be made.

(1) West Hackberry coexpansion is preferred at lower values of benefit discounting, whereas Cote Blanche is preferred at higher value of discounting.

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[1] Project life is defined as the "backstop" year. The backstop year is that year when the real price of oil is such that alternative fuels replace petroleum. In this analysis the backstop year is 2004. (For further discussion see Section V.)

Table III.3. Ratio of Time Preference (Discount) Rate on Cumulative Capacity for Full Project Life to Present Value of Facilities and Oil Cost Less Salvage Value

	Present Value (81) of Real Facilities and Oil Costs Less Salvage Cost (Millions)		Discount Rate				
			0%	5%	10%	15%	20%
Base Module	13,823	a[1]	12,150.0	6763.6	4199.9	2848.5	2069.1
		b[2]	.879	.489	.504	.206	.150
(1) West Hackberry							
Coexpansion	477	a	462.0	216.6	108.7	57.6	31.8
		b	.986	.454	.228	.120	.066
Deferred	495	a	465.0	220.9	113.5	62.3	36.2
		b	.938	.445	.229	.125	.073
(2) Big Hill							
100 MMB	1975	a	1626.0	788.7	414.9	233.7	139.3
		b	.823	.399	.210	.118	.070
140 MMB	2483	b	2173.0	1033.4	531.4	2921	169.8
		b	.875	.416	.214	.117	.068
(3) New Solution-Mined Site	2134	a	1754.0	813.9	406.9	216.9	122.1
		b	.822	.381	.191	.102	.057
(4) Cote Blanche	1110	a	778.0	412.5	240.8	152.0	102.1
		b	.700	.372	.217	.137	.092
(5) Steel Tanks							
40 MMB (FY 82)	981	a	700.0	352.0	193.3	114.2	71.6
		b	.713	.358	.196	.116	.072
30 MMB (FY 83)	770	a	538.0	273.6	152.1	91.1	57.9
		b	.698	.355	.197	.118	.075

[1] Discounted Barrel years

[2] Ratio of discounted barrel-years to present value of costs less salvage

Table III.4. Ratio of Time Preference (Discount) Rate on Cumulative Capacity for Half-Project Life to Present Value of Facilities and Oil Cost Less Salvage Value

	Present Value (81) of Real Facilities and Oil Costs Less Salvage Cost (Millions)		Discount Rate				
			0%	5%	10%	15%	20%
Base Module	8,028	a^1	5153.0	3728.2	2790.5	2152.8	1705.9
		b^2	.679	.464	.348	.268	.212
(1) West Hackberry							
Coexpansion	177	a^1	102.0	61.1	37.1	22.7	13.9
		b^2	.575	.345	.209	.128	.078
Deferred	196	a^1	105.0	65.5	41.8	27.3	18.2
		b^2	.536	.334	.213	.139	.093
(2) Big Hill							
100 MMB	975	a^1	426.0	270.5	176.1	117.2	79.6
		b^2	.436	.277	.180	.120	.081
140 MMB	1084	a^1	493.0	307.9	197.1	129.0	86.2
		b^2	.454	.283	.181	.118	.079
(3) New Solution-Mined Site	886	a^1	314.0	192.0	120.3	77.1	50.4
		b^2	.354	.217	.136	.087	.057
(4) Cote Blanche	674	a^1	298.0	205.2	145.3	105.4	78.2
		b^2	.442	.304	.216	.156	.116
(5) Steel Tanks							
40 MMB (FY 82)	582	a^1	220.0	144.7	97.7	67.6	47.7
		b^2	.378	.248	.168	.116	.082
30 MMB (FY 83)	471	b^2	176.0	118.1	80.5	56.1	40.0
		b^2	.378	.251	.170	.119	.084

[1] Discounted barrel years

[2] Ratio of discount barrel-years to present value of costs less salvage

FIGURE III.3: RATIO OF TIME PREFERENCE (DISCOUNT) RATE ON CUMULATIVE CAPACITY FOR FULL PROJECT LIFE TO PRESENT VALUE OF FACILITIES AND OIL LESS SALVAGE VALUE.

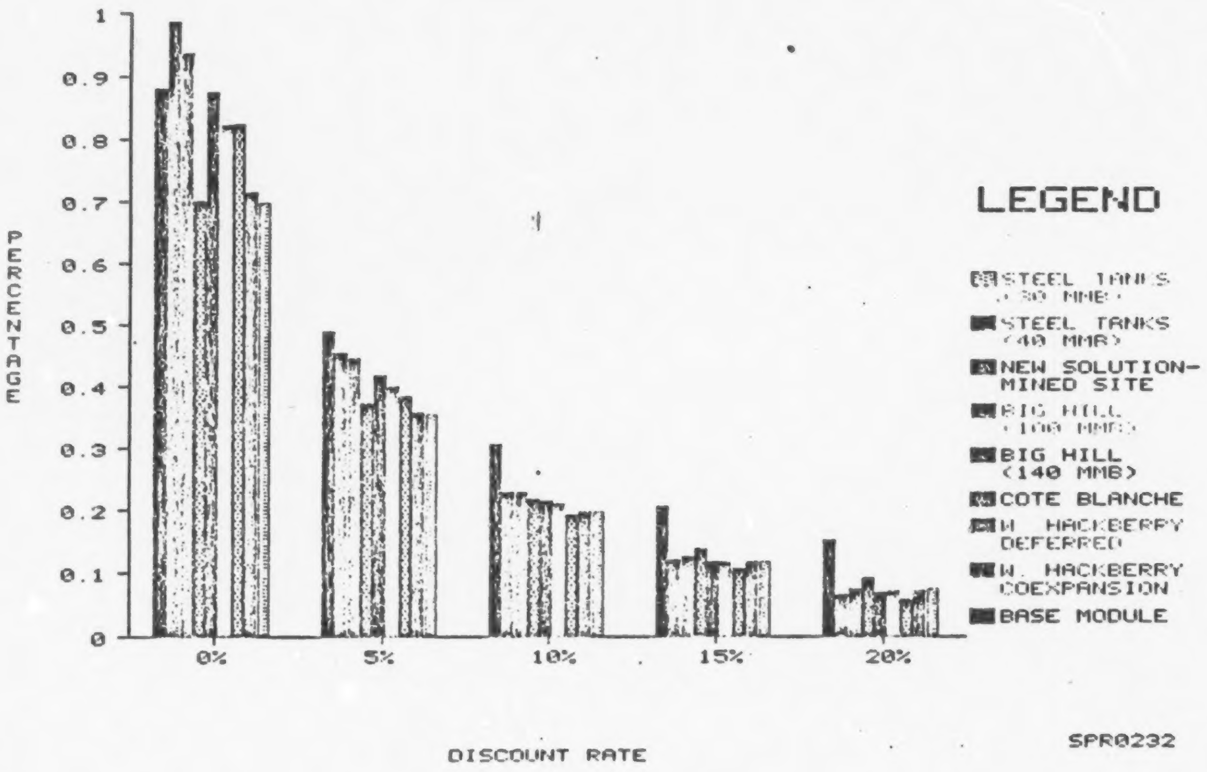
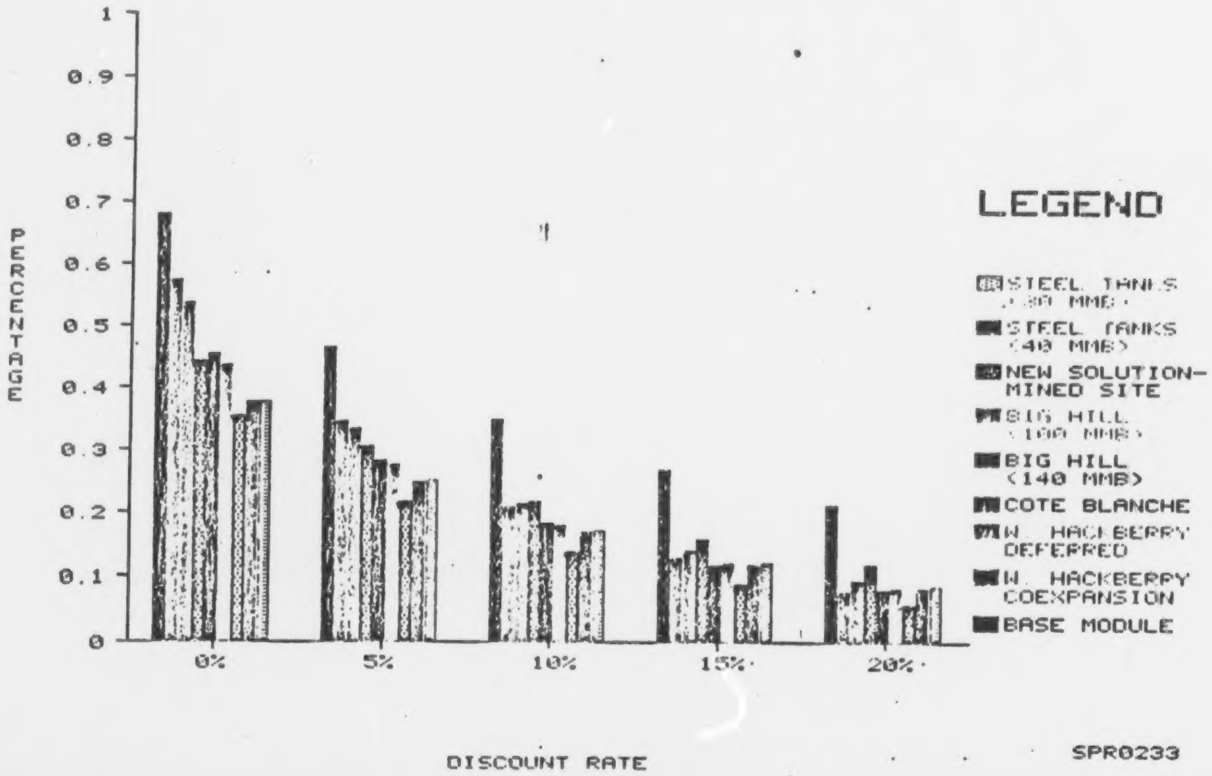


FIGURE III.4: RATIO OF TIME PREFERENCE (DISCOUNT) RATE ON CUMULATIVE CAPACITY FOR HALF PROJECT LIFE TO PRESENT VALUE OF FACILITIES AND OIL LESS SALVAGE VALUE



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(2) Steel tanks are less cost-effective than any other alternative except for high rates of discounting benefits if the entire project life is considered. They are only marginally preferred in the near term over a new 120 MMB salt dome site.

(3) Cote Blanche is more cost-effective than both versions of Big Hill except when benefits are discounted at a low rate over the full project life.

(4) Big Hill 140 is preferred over Big Hill 100 except for high discounting of benefits.

SECTION IV

DESCRIPTION OF SPR SYSTEM ALTERNATIVES

Based on the rank evaluation in Section III, we have drawn the following conclusions:

(1) That the composition of the 750 MMB program in the FY 1982 budget --the Base Module (580 MMB) plus the 30 MMB coexpansion of West Hackberry plus the development of 140 MMB in capacity at Big Hill --is the preferred composition if SPR development is to terminate at 750 MMB. The West Hackberry and Big Hill increments rank consistently high using a wide range of alternative criteria. Specifically, these increments rank above all others except Cote Blanche for the following criteria.

- Minimization of the unit cost of facilities in nominal dollars, real dollars, and the present value of real dollars.
- Minimization of real dollar program (oil plus facilities) costs per barrel.
- Ratio of discounted facility capacity increments to present value of facilities costs, for all discount rates.
- Ratios of discounted barrel-years of protection to total program investment value (present value of facilities and oil costs net of salvage value) up to and including benefit discount rates of 10 percent per year.

(2) Under most circumstances, Cote Blanche is the most attractive competition to the current 750 MMB program composition. It should have priority in any decision to go beyond 750 MMB total system size. In some measures, it is preferred to some portions of the current configuration but such preference is sensitive to

estimates of the ultimate storage capacity of the Cote Blanche mine. For example, on Tables III.2 and III.3, Cote Blanche appears preferable to Big Hill 140 at a 10 percent benefit discount ratio, but a 10 percent reduction in the 40 MMB estimated Cote Blanche capacity would make the preference for these two projects equivalent. Yet, no such 10 percent reduction in capacity would render Cote Blanche less attractive than steel tanks.

(3) A new solution-mined site, while less attractive than Cote Blanche, could be more or less attractive than steel tanks, depending on one's time preference (discount) rate and on project duration. Solution mining is slower but cheaper and could be preferable if one's concern is with facilities costs and not with schedule. A continuation of the program to the end of this century makes a new solution-mined site attractive relative to steel tanks, but if one's only concern is with the current decade, steel tanks make more sense.

Based on these general findings, we have developed the following SPR System alternatives for consideration:

SYSTEM #1 750 MMB SYSTEM (FY 1983)

This system consists of the 580 MMB Base Module, the West Hackberry coexpansion and the Big Hill site developed to 140 MMB. The configuration is thus the same as the FY 1982 budget plan, but the schedule is different because of the acceleration of Bryan Mound leaching. Table IV.1 presents the buildup of the oil fill schedule for this system.

Assuming that the SPR is filled to capacity (267 MMB) at the end of FY 1982, the following (refer to Table IV.2) are the fill levels for future years expressed as total annual fill and average daily fill rates.

Table IV.1. 750 MMB System (1983)
Oil Fill Capability
(Cumulative MMB, end of fiscal year)

	1981	1982	1983	1984	1985	1986	1987	1988	1989
Base Module	251	267	343	417	467	563	580	580	580
West Hackberry Coexpansion	0	0	0	0	-11	-25	+18	30	30
Big Hill 140	0	0	0	0	0	0	13	60	140
750 MMB System	251	267	343	417	456	538	611	670	750
FY 1982 Budget	248	261	331	398	409	481	605	687	750
Change	+3	+6	+12	+19	+47	+57	+6	-17	0

Table IV.2. 750 System (1983)
Annual Oil Fill Levels

Fiscal Year	Annual Total (MMB)	Average Daily Rate MBD
1983	76	208
1984	74	203
1985	39	107
1986	82	225
1987	73	200
1988	59	162
1989	80	219
Average	69	189

In no year would fill equal or even approach 300 MBD unless a substantial underfill had occurred in the prior year. If in one of the seven fiscal years, fill were constrained to about 100 MBD (37 MMB/year), the Energy Security Act minimum, then an average rate of fill of 200 MBD would be achieved in the other six fiscal years.

SYSTEM #2. 790 MMB SYSTEM

This system consists of the 750 MMB System (System #1) plus the addition of the Cote Blanche site at 40 MMB. Table IV.3 presents the oil fill capability for this system.

Table IV.3. 790 MMB System
Oil Fill Capability
(Cumulative MMB, End of Fiscal Year)

	1981	1982	1983	1984	1985	1986	1987	1988	1989
750 MMB System (1983)	251	267	343	417	456	538	611	670	750
Cote Blanche	0	0	0	18	40	40	40	40	40
790 MMB System	251	267	343	435	496	578	651	710	790
Annual Fill (MMB)			76	92	61	82	73	59	80
Average Daily Fill (MBD)			208	252	167	225	200	162	219

The average annual fill for the FY 1983- 1989 period increases to almost 75 MMB/year (205 MBD) for the 790 MMB system in comparison to the 750 MMB alternative.

Two years would be filled at less than 200 MMD (1986 and 1988) unless a prior year had been underfilled. If oil fill were constrained to 100 MBD in one of the years, an average fill rate of 222 MBD could be achieved in the remaining six years.

As noted in Section II, the Cote Blanche increment assumes FY 1982 funding of over $200 million from a budget amendment. If this funding were obtained from an FY 1982 supplemental, available in the Spring of 1982, then a 6-month delay would ensue, slipping the entire 40 MMB in fill into FY 1985. A full year delay in funding until FY 1983 would result in a full year delay in the fill capability schedule.

SYSTEM #3. 890 MMB SYSTEM

This system consists of the 790 MMB system described above plus a further 100 MMB in steel tank development: one 40 MMB site funded in FY 1982 plus two further sites, each 30 MMB, funded in FY 1983. Table IV.4 presents the fill capability for this system.

Table IV.4. 890 MMB System
Oil Fill Capability
(Cumulative MMB, End of Fiscal Year)

	1981	1982	1983	1984	1985	1986	1987	1988	1989
790 MMB System	251	267	343	435	496	578	651	710	790
40 MMB Steel Tanks	0	0	0	0	8	20	32	40	40
60 MMB Steel Tanks	0	0	0	0	16	40	60	60	60
Total, 890 MMB System	251	267	343	435	520	638	743	810	890
Annual Fill (MMB)			76	92	85	118	105	67	80
Fill Rate (MBD)			208	252	233	323	288	184	219

The average fill rate for the FY 1983 - 1980 period would be 244 MBD, increasing to 268 MBD for six years if fill were constrained to 100 MBD for one year.

SYSTEM #4. 1000 MMB SYSTEM - MIXED

This system consists of the 890 MMB System (#3) which includes 100 MMB in steel tanks, plus the addition of a 120 MMB solution-mined site filled to 110 MMB. Table IV.5 outlines the capacity schedule associated with this option.

Table IV.5. 1000 MMB System - Mixed
Oil Fill Capability
(Cululative MMB, End of Fiscal Year)

	1982	1983	1984	1985	1986	1987	1988	1989	
890 MMB System	267	343	435	520	638	743	810	890	890
One Solution-mined Site	---	---	---	---	---	---	14	60	110
1000 MMB System-Mixed	267	343	435	520	638	743	824	950	1000
Annual Fill (MMB)		76	92	85	118	105	81	126	50
Fill Rate (MMB)		208	252	233	323	288	222	345	137

In comparison to exclusive reliance on steel tanks for the 790 - 1000 MMB increment (System #5), this system defers the high "spike" year of annual fill from 1987 to 1989 and solves the qualitative problem of the marginal difficulties in locating additional steel tank sites.

SYSTEM #5. 1000 MMB SYSTEM -STEEL TANKS ONLY

This system would emphasize schedule over cost, entailing the 890 MMB system described above plus a further 110 MMB in steel tanks, funded in FY 1984. Thus the overall system would include a total of 210 MMB in steel tanks. Table IV.6 presents the fill capability for this system.

Table IV.6. 1000 MMB System - Steel Tanks Only

Oil Fill Capability

(Cumulative MMB, end of fiscal year)

	1981	1982	1983	1984	1985	1986	1987	1988	1989
890 MMB System	251	267	343	435	520	638	743	810	890
110 MMB Steel Tanks	0	0	0	0	0	24	60	94	110
1000 MMB System-Steel Tanks Only	251	267	343	435	520	662	803	904	1000
Annual Fill (MMB)			76	92	85	142	141	101	96
Avg. Daily Fill (MBD)			208	252	233	389	387	277	263

This system permits average annual fill of 105 MMB (287 MBD) over the 1983 - 1989 period, or 116 MMB (318 MBD) for six years if fill is constrained to 100 MBD in one year. With a projected oil price of nearly $65/bbl in 1987, annual oil costs would peak in that year at $9.5 billion, considerably more than the current budget level.

One factor which may not be adequately treated in this system proposal is the potential problem associated with identifying six sites for very large steel tank development. While there is no current empirical basis for analyzing this phenomenon, one could project that from the standpoint of both economics and environmental and community aspects, each successive steel tank site will be marginally more difficult to identify and secure for SPR use. Also, each successive steel tank development project would have marginally greater impact on the capacity utilization in the steel tank fabrication industry. While we understand that unused productive capacity exists, it is reasonable to expect that the development of 210 MMB in steel tanks would have disproportionate effects on the industry in relation to a 100 MMB steel tank system.

One other factor not adequately treated here is the environmental problems of steel tanks which may require the government to acquire "offsets" (reduction in pollution from other sources) which may add costs and delay completion of the tank farms.

Table IV.7 summarizes the oil fill capability schedules for all alternatives and Table IV.8 summarizes annual fill rates for all systems alternatives.

In considering alternative methods of financing the SPR, the Congress is contemplating setting an annual average daily fill target of 300 MBD (S.918, HR 3808) or 230 MBD (S.1343). These fill levels translate into the cumulative fill requirements after 1982 noted on the bottom of Table IV.8, assuming the SPR is filled to capacity in these years.

None of the systems can meet either of these requirements in FY 1983 and there is no known construction method which could solve this shortfall. The 790 MMB System (B) could meet the 230 MBD criterion during the 1984-1986 period and, through the use of at least 100 MMB in steel tanks, this criterion could be met for all years after 1983.

The 300 MBD criterion is essentially unachievable by all systems alternatives.

Program Costs

Section III illustrated the variety of methods by which program cost information can be portrayed. The appendix contains the detailed information on the costs for each increment and each total system. Table IV.8 contains a summary of SPR system alternatives and Table IV.9 presents a summary of the oil and facilities costs for each system alternative, expressed in Table IV.10 on a per-barrel basis. Table IV.11 presents the near-term (FY 1982-1984) budget authority and outlay requirements for each system.

Table IV.7. Summary of SPR System Alternatives
Oil Fill Capability Schedules

(Cumulative MMB, End of Fiscal Year)

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
#1. 750 MMB(1983)	251	267	343	417	456	538	611	670	750	750
#2. 790 MMB	251	267	343	435	496	578	651	710	790	790
#3. 890 MMB	251	267	343	435	520	638	743	810	890	890
#4. 1000 MMB-Mixed	251	267	343	435	520	638	743	824	950	1000
#5. 1000 MMB-Steel tanks	251	267	343	435	520	662	803	904	1000	1000
230 MBD			351	435	519	603	687	750		
300 MBD			377	486	596	705	750			

Table IV.8. Summary of SPR System Alternatives
Annual and Average Daily Oil Fill Rates

(Annual Fill in MMB, Average Daily Fill in MBD)

Fiscal Year

		1983	1984	1985	1986	1987	1988	1989	1990
#1. 750 MMB (1983)	MMB/YR	76	74	39	82	73	59	80	0
	MBD	208	203	107	225	200	162	219	0
#2. 790 MMB	MMB/YR	76	92	61	82	73	59	80	0
	MBD	208	252	167	225	200	162	219	0
#3. 890 MMB	MMB/YR	76	92	85	118	105	67	80	0
	MBD	208	252	233	323	288	184	219	0
#4. 1000 MMB-Mixed	MMB/YR	76	92	85	118	105	81	126	50
	MBD	208	252	233	323	288	222	345	137
#5. 1000 MMB Steel Tanks	MMB/YR	76	92	85	142	141	101	96	0
	MBD	208	252	233	389	387	277	263	0

Table IV.9. Funding Requirements for Alternative Systems
(In Millions)

		NOMINAL DOLLARS			REAL 1981 DOLLARS		
SYSTEM	MMB	FACILITIES	OIL	TOTAL	FACILITIES	OIL	TOTAL
#1	750	$ 3,100	$37,406	$40,506	$2,853	$28,041	$30,894
#2	790	$ 3,324	$39,547	$42,871	$3,038	$29,718	$32,756
#3	890	$ 4,708	$45,666	$50,374	$3,991	$34,127	$38,118
#4	1000	$ 5,757	$54,089	$59,846	$4,658	$39,438	$44,096
#5	1000	$ 6,177	$52,995	$59,172	$4,913	$39,142	$44,055

Table IV.10.· Per-Barrel Costs for Alternative Systems

	NOMINAL DOLLARS			REAL 1981 DOLLARS		
SYSTEM	FACILITIES	OIL	TOTAL	FACILITIES	OIL	TOTAL
#1	$4.13	$49.87	$54.00	$3.80	$37.39	$41.19
#2	$4.21	$50.06	$54.27	$3.84	$37.62	$41.46
#3	$5.29	$51.31	$56.60	$4.48	$38.34	$42.83
#4	$5.76	$54.10	$59.86	$4.66	$39.44	$44.10
#5	$6.18	$53.00	$59.17	$4.91	$39.14	$44.06

Table IV.11. Near-Term Budget Requirements for Alternative Systems
(In Millions)

SYSTEM[1]	FY 1982		FY 1983		FY 1984	
	BA	BO	BA	BO	BA	BO
#1	$3,883	$3,625	$4,933	$3,845	$3,183	$4,429
#2	$4,097	$3,680	$4,939	$3,952	$5,332	$5,105
#3	$4,654	$3,791	$5,716	$4,013	$6,001	$5,418
#4	$4,658	$3,795	$5,785	$4,071	$6,149	$5,552
#5	$4,676	$3,795	$5,834	$4,127	$7.298	$5,538

[1] Includes planning and program direction costs.

SECTION V

ECONOMIC COST ANALYSIS OF ALTERNATIVE SPR SYSTEMS

This section presents the results of a benefit-cost analysis of the economic value of several alternative configurations for the Strategic Petroleum Reserve (SPR). These SPR alternatives--defined and discussed in the previous chapter--include five systems, 750 MMB, 790 MMB, 890 MMB, and two 1,000 MMB sizes.

The economic concept employed in this analysis to develop a benefit-cost measure is based on the idea of social surplus loss. Here, a given SPR system is evaluated with respect to its ability to reduce the social surplus loss associated with a disruption to the nation's supply of oil. At its simplist, the social surplus concept evaluates the increased cost of oil faced by consumers multiplied by the quantity consumed. It negatively affects consumers of oil who continue to buy at higher prices; and it also negatively affects those who are forced to forego consumption. On the other hand, it positively affects the domestic producers of oil who obtain more revenue due to the price increase stemming from the supply shortfall.[1]

The particular methodological formulation of the social surplus loss approach followed here is based on the utilization of a multi-period stochastic dynamic programming model produced for the Office of Policy and Analysis of this agency by Dr. Tom Teisberg in 1977.

Although the Teisberg model does indeed offer an objective and fairly realistic method of approaching the evaluation of a given SPR alternative system, this model--like most such models--is intrinsically dependent on the exogeneous selection of a specific set of economic assumptions. In sum, these assumptions relate to the future character of the world oil market and also to the likelihood of a world oil shortfall. Changing these assumptions necessarily and directly affects the output of the Teisberg model.

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[1] There are, in fact, other types of analyses which might be carried out to estimate the economic benefit of a given SPR system. One such, based on the concept of gross national product loss averted, attempts to calculate some roughly analogous figure that is at once less precise and more comprehensive in its formulation.

Aside from this dependency on important assumptions, the Teisberg model (in the present formulation used here) tends to be somewhat insensitive to small differences in the fill capacity schedule of alternative SPR systems. Data input procedures call for rounding the SPR capacity to the nearest 50 MMB. The practical effect is to sometimes understate and other times overstate the given SPR system's benefit by magnitudes of up to 50 million barrels. Table V.1 shows the comparison of actual fill capacity schedules for each of the five SPR options analyzed in this report to indexes of fill capacity schedules used by the model, illustrating the effects of this procedure.

The basic element of the Teisberg model is an oil market "insecurity cost function." This function depends primarily on the nature of the world oil market that would be faced by a given SPR program over its operational life. In this analysis, world oil markets are represented by three characteristics "states":

(1) a "slack" market, wherein SPR oil purchases would take place without any impact on the world oil market in general;

(2) a "tight" market, wherein SPR oil acquisitions would raise the world oil price at a rate of $1.50/bbl. for each 500 thousand barrels per day. This would have the effect of increasing the oil price about 60 cents per barrel at current SPR oil fill levels of 200 thousand barrels per day; and

(3) an oil market supply disruption "state" that assumes an OPEC delivery cutback amounting to about 12 million barrels per day, or 40 percent of OPEC's current total output.

Markov chain probability transition matrices are used to manipulate statistical assumptions about the likelihood of encountering each of these market states each year. This analysis evaluates the significance of a wide range of assumptions regarding encountering such an oil supply disruption as described in (3), ranging from 0 percent yearly to 20 percent yearly.

It should be remembered, however, that these seemingly modest assumptions about likelihood of yearly disruption translate into far higher values when considered in terms of the probability of experiencing at least one such disruption over the lifespan of the project. For example, a 5 percent likelihood of yearly disruption implies a 71 percent likelihood of at least one such disruption over a 24-year project lifespan.

OTHER ESSENTIAL ASSUMPTIONS

Several other important assumptions are made in the implementation of the Teisberg model. The world oil price path is assumed to begin at $34 per barrel in 1981, rising by 3 percent per year until it reaches a "backstop" price of $75 per barrel in year 2004. In that year, imported oil is assumed to be no longer essential for the nation's economic well-being, and therefore the SPR oil can be sold off and the project discontinued.

The primary costs of the SPR are the costs of purchasing or acquiring the oil, plus the holding costs. Of course,the cost of acquiring the oil is the market price at the time the oil is purchased plus the transportation cost when it is delivered. The holding cost, on the other hand, has two components;

(1) the cost of building and maintaining the storage facilities;

(2) the opportunity or capital cost of holding onto a valuable commodity. A discount rate of 10 percent is used to represent the return that could be received from the next most comparable investment.

OPTIMIZATION RESULTS

Table V.2 presents the results of the Teisberg model evaluation of the five alternative hypothetical systems considered in this analysis.

Table V.1. Illustration of the Translation Procedure Employed to Introduce Values for the Fill Capacity Schedule of Each Alternative SPR Hypothetical Option to the Teisberg Model

	SPR Options: Fill Capacity Schedule (MMB)				
Year	750	790	890	1,000	1,000
1981	251	251	251	251	251
1982	267	267	267	267	267
1983	343	343	343	343	343
1984	417	435	435	435	435
1985	456	496	520	496	523
1986	538	578	638	578	668
1987	610	650	742	650	808
1988	670	710	810	738	898
1989	750	790	890	910	1,000
1990	750	790	890	1,000	1,000
	SPR Options: Fill Capacity Model Schedule Translation (Index)				
1981	6	6	6	6	6
1982	6	6	6	6	6
1983	8	8	8	8	8
1984	9	10	10	10	10
1985	10	11	11	11	11
1986	12	13	14	13	14
1987	13	14	16	14	17
1988	14	15	17	16	19
1989	16	17	19	19	21
1990	16	17	19	21	21

As is indicated, the net economic benefit (expressed as consumer surplus loss avoided) of all of the five alternatives is negative in the instance where the likelihood of shortfall is zero. However, it rises quickly into a positive value for each of the alternatives at the 1 percent mark for probability of shortfall escalating upward to over $323 billion under the assumption of a 20 percent annual probability of shortfall in the instance of the second billion barrel SPR alternative. In each case, there is a positive correlation between likelihood of shortfall and consumer surplus loss avoided.

Table V.3 presents these same results in terms of an ordinal ranking. It suggests a systematic shift of optimality from the smaller to the larger of the alternatives as the probability of a shortfall is assumed to advance. In the instance of a very small likelihood of shortfall, the 750 MMB system proves out to be the optimal system. However, by the time that the probability is scaled upwards to 4 percent, the 750 MMB system is shown to be relegated to last place in terms of optimality.

Table V.2. Results of Teisberg Model Analysis: Net Expected Economic Benefits [2] ($billion)

Assumed Probability of Shortfall		SYSTEM				
Yearly	Project Life[1]	(1) 750	(2) 790	(3) 890	(4) 1,000	(5) 1,000
		(tight market condition)				
0.0	0.0	-6.7	-6.8	-7.3	-7.7	-8.0
1.0	.21	5.53	5.38	4.87	4.51	4.15
2.0	.38	20.72	20.68	20.17	19.81	19.45
3.0	.48	40.79	41.24	41.31	41.01	40.72
4.0	.62	60.34	61.43	62.15	63.04	62.82
5.0	.71	79.18	80.85	82.88	83.72	83.73
10.0	.92	162.92	166.89	172.26	175.20	175.75
15.0	.98	230.12	241.85	242.87	246.77	247.60
20.0	.99+	283.16	298.67	297.22	301.72	302.65
		(slack market condition)				
5.0	.71	90.18	92.74	96.22	98.42	98.68
10.0	.92	176.81	181.74	188.68	192.83	193.63
15.0	.98	246.49	252.80	261.27	266.29	267.45
20.0	.99+	301.03	307.98	316.80	322.21	323.37

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[1] Expresses the statistical chance of encountering at least one such oil supply shortfall over the project life of 24 years running from 1981 to 2004 inclusive.

[2] Represents expected consumer surplus loss avoided based on SPR oil transactions less costs of SPR storage facilities.

Table V.3. Rank Ordering of the Results of the Teisberg Model Analysis According to Size of Consumer Surplus Loss Avoided

Assumed Probability of Shortfall		SYSTEM				
Yearly	Project Life[1]	(1) 750	(2) 790	(3) 890	(4) 1,000	(5) 1,000
				(tight market condition)		
0.0.	. .0.0	N/A	N/A	N/A	N/A	N/A
1.0.	. .21	1	2	3	4	5
2.0.	. .38	1	2	3	4	5
3.0.	. .48	4	2	1	3	5
4.0.	. .62	5	4	3	1	2
5.0.	. .71	5	4	3	2	1
10.0.	. .92	5	4	3	2	1
15.0.	. .98	5	4	3	2	1
20.0.	. .99+	5	4	3	2	1
				(slack market condition)		
5.0.	. .71	5	4	3	2	1
10.0.	. .92	5	4	3	2	1
15.0.	. .98	5	4	3	2	1
20.0.	. .99+	5	4	3	2	1

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[1] Expresses the statistical chance of encountering at least one such oil supply shortfall over the project life of 24 years running from 1981 to 2004 inclusive.

APPENDIX A: DETAILED DATA

BASE MODULE ALTERNATIVE INCREMENTS TO BASE MODULE BASELINE SYSTEM ALTERNATIVE SYSTEMS

This appendix presents costs, fill capability and fill data for the Base Module and alternative increments to that module for achieving a 750 MMB System (Tables A-1 through A-9). Additionally, it presents fully detailed budget requirements for achieving the 750 MMB Baseline System and alternative larger systems of 790 MMB, 890 MMB and 1,000 MMB, respectively (Tables A-11 through A-14).

The individual tables are identified as follows:

A-1 PROJECT DATA SHEET - BASE MODULE
A-2 PROJECT DATA SHEET - WEST HACKBERRY 30 MMB COEXPANSION
A-3 PROJECT DATA SHEET - WEST HACKBERRY 30 MMB DEFERRED
A-4 PROJECT DATA SHEET - BIG HILL 100 MMB
A-5 PROJECT DATA SHEET - BIG HILL 140 MMB
A-6 PROJECT DATA SHEET - NEW 120 MMB SOLUTION-MINED SITE
A-7 PROJECT DATA SHEET - COTE BLANCHE 40 MMB
A-8 PROJECT DATA SHEET - STEEL TANKS 40 MMB
A-9 PROJECT DATA SHEET - STEEL TANKS 30 MMB
A-10 BUDGET AUTHORITY REQUIREMENTS - 750 MMB BASELINE SYSTEM
A-11 BUDGET AUTHORITY REQUIREMENTS - 790 MMB UNDERGROUND SYSTEM
A-12 BUDGET AUTHORITY REQUIREMENTS - 890 MMB MIXED SYSTEM
A-13 BUDGET AUTHORITY REQUIREMENTS - 1,000 MMB MIXED SYSTEM
A-14 BUDGET AUTHORITY REQUIREMENTS - 1,000 MMB STEEL TANKS SYSTEM

TABLE A-1
PROJECT DATA SHEET
580 MMB BASE MODULE

	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	TOTAL
Facilities (in Millions of $)														
Phase I														
Nominal (Budget) Dollars														
BA	300	382	174	-	-	-								856
BO	51	318	374	29	59	25								856
Phase II														
Nominal Dollars														
BA		65	422	-	40	34	49	63	21	8	-			702
BO		3	80	173	160	80	92	52	40	17	5			702
Phase III - Bryan Mound														
Nominal Dollars														
BA					1	19	25	6	37	19	10	-	-	117
BO					1	12	30	6	15	35	18	-	-	117
Non Phase Specific[1]														
Nominal Dollars														
BA		17	36	-	40	41	87	78	78	81	72	-		530
BO			6	19	34	37	97	90	65	87	87	8		530
Total Facilities														
Nominal Dollars														
BA	300	464	632	-	81	94	161	147	136	108	82	-		2205
BO	51	321	460	221	254	154	219	148	120	139	110	8		2205
Real (1981) Dollars				1302[2]	254	140	181	111	81	86	62	4		2226
PV in 1981 of Real Dollars				1619[2]	254	127	150	83	55	53	35	2		2378
Cumulative Fill Capability (MMB)				250[2]	251	267	343	417	467	563	580	580	580	
Annual Fill (MMB)				93[2]	104	70	76	74	50	96	17			580
Oil Cost (in Millions of $)														
Nominal Dollars				1350[2]	3925	2960	3551	3782	2746	5662	1061			25037
Real Dollars				1653[2]	3925	2691	2935	2841	1875	3515	598			20033
PV in 1981 of Real Dollars				2117[2]	3925	2224	2426	2134	1280	2182	337			16847

[1] Includes withdrawal Engineering, Sustaining Operations and Phase III A/E Contract

[2] Cumulative total through FY 1980

TABLE A-2
PROJECT DATA SHEET
WEST HACKBERRY 30 MMB COEXPANSION

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	TOTAL
Facilities (in Millions of $)											
Nominal (Budget) Dollars											
BA	1	3	34	13	13	15	17				96
BO		2	21	22	13	1	24	10	2	1	96
Real (1981) Dollars		2	17	17	9	1	14	5	1	-	66
PV in 1981 of Real Dollars		2	14	13	6	-	8	3	-	-	46
Cumulative Fill Capability (MMB)					-11	-25	+18	+30	+30	+30	
Annual Fill (MMB)					-11	-14	+43	+12			30
Oil Price:											
Nominal Dollars					55.51	60.02	64.65	69.61			
Real Dollars					42.48	43.75	45.06	46.42			
Oil Cost (in Millions of $)											
Nominal Dollars					-611	-840	2780	835			2164
Real Dollars					-467	-613	1938	557			1415
PV in 1981 of Real Dollars					-319	-380	1094	286			681

TABLE A-3
PROJECT DATA SHEET
WEST HACKBERRY - 30 MMB DEFERRED

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	TOTAL
Facilities (in Millions of $)											
Nominal (Budget) Dollars											
BA				9	35	16	38	42	22	-	162
BO				2	25	27	43	39	21	5	162
Real (1981) Dollars				2	17	17	24	20	10	2	92
PV in 1981 of Real Dollars				2	12	11	14	10	5	1	55
Cumulative Fill Capability (MMB)							1	14	30	30	
Annual Fill (MMB)							1	13	16		30
Oil Price:											
Nominal Dollars							64.65	69.61	74.94		
Real Dollars							45.06	46.42	47.81		
Oil Cost (in Millions of $)											
Nominal Dollars							65	905	1199		2169
Real Dollars							45	603	765		1413
PV in 1981 of Real Dollars							25	309	357		691

TABLE A-4

PROJECT DATA SHEET

BIG HILL : 100 MMB

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	TOTAL
Facilities (in Millions of $)												
Nominal (Budget) Dollars												
BA	1	81	355	78	64	42	40	51				712
BO		47	175	195	130	58	41	54	7	5	-	712
Real (1981) Dollars		43	145	147	89	36	23	28	3	2	-	516
PV in 1981 of Real Dollars		39	120	110	61	22	13	14	1	-	-	380
Cumulative Fill Capability (MMB)						1	25	100	100	100	100	
Annual Fill (MMB)						1	24	75				100
Oil Price:												
Nominal Dollars						60.22	64.65	69.61				
Real Dollars						43.75	45.06	46.42				
Oil Cost (in Millions of $)												
Nominal Dollars						60	1552	5221				6833
Real Dollars						44	1081	3482				4607
PV in 1981 of Real Dollars						27	610	1787				2424

TABLE A-5

PROJECT DATA SHEET

BIG HILL - 140 MMB

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	TOTAL
Facilities (in Millions of $)												
Nominal (Budget) Dollars												
BA	1	81	390	78	64	42	40	50	53	-	-	799
BO		47	184	221	130	58	41	56	50	7	5	799
Real (1981) Dollars		43	152	166	89	36	23	29	23	3	2	566
PV in 1981 of Real Dollars		39	126	125	61	22	13	15	11	1	1	414
Cumulative Fill Capability (MMB)							13	60	140	140	140	
Annual Fill (MMB)							13	47	80			140
Oil Price:												
Nominal Dollars							64.65	69.61	74.94			
Real Dollars							45.06	46.42	47.81			
Oil Cost (in Millions of $)												
Nominal Dollars							840	3272	5995			10107
Real Dollars							586	2182	3825			6593
PV in 1981 of Real Dollars							331	1120	1784			3235

TABLE A-6

PROJECT DATA SHEET

NEW 120 MMB SOLUTION-MINED SITE

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	TOTAL
Facilities (in Millions of $)												
Nominal (Budget) Dollars												
BA			66	145	397	202	60	66	73	40		1049
BO			55	131	355	236	84	65	72	45	6	1049
Real (1981) Dollars			45	98	242	147	47	33	34	19	2	667
PV in 1981 of Real Dollars			37	74	165	91	27	17	16	8	1	436
Cumulative Fill Capability (MMB)								14	60	120	120	
Annual Fill (MMB)								14	46	60		120
Oil Price:												
Nominal Dollars								69.61	74.94	80.02		
Real Dollars								46.42	47.81	49.24		
Oil Cost (in Millions of $)												
Nominal Dollars								975	3447	4801		9223
Real Dollars								650	2199	2954		5803
PV in 1981 of Real Dollars								334	1026	1252		2612

TABLE A-7
PROJECT DATA SHEET
COTE BLANCHE - 40 MMB

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	TOTAL
Facilities (in Millions of $)											
Nominal (Budget) Dollars											
BA		213	4	7							224
BO		54	106	61	3						224
Real (1981) Dollars		49	88	46	2						185
PV in 1981 of Real Dollars		45	73	35	1						154
Cumulative Fill Capability (MMB)				18	40	40	40	40	40	40	
Annual Fill (MMB)				18	22						40
Oil Price:											
Nominal Dollars				51.11	55.51						
Real Dollars				41.24	42.48						
Oil Cost (in Millions of $)											
Nominal Dollars				920	1221						2141
Real Dollars				742	935						1677
PV in 1981 of Real Dollars				557	639						1196

TABLE A-8
PROJECT DATA SHEET
STEEL TANKS - 40 MMB

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	TOTAL
Facilities (in Millions of $)											
Nominal (Budget) Dollars											
BA	6	496		1	2	3	5	5			518
BO		38	58	105	117	104	60	36			518
Real (1981) Dollars		35	48	79	80	65	34	18			359
PV in 1981 of Real Dollars		32	40	59	55	40	19	9			254
Cumulative Fill Capability (MMB)					8	20	32	40	40	40	
Annual Fill (MMB)					8	12	12	8			40
Oil Price:											
Nominal Dollars					55.51	60.02	64.65	69.61			
Real Dollars					42.48	43.75	45.06	46.42			
Oil Cost (in Millions of $)											
Nominal Dollars					444	720	776	557			2497
Real Dollars					340	525	541	371			1777
PV in 1981 of Real Dollars					232	326	305	191			1054

TABLE A-9
PROJECT DATA SHEET
STEEL TANKS - 30 MMB

	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	TOTAL
Facilities (in Millions of $)											
Nominal (Budget) Dollars											
BA	6	29	388	1	2	3	4				
BO		35	1	104	135	86	72				433
Real (1981) Dollars		32	1	78	92	53	41				433
PV in 1981 of Real Dollars		29	1	59	63	33	23				297
Cumulative Fill Capability (MMB)					8	20	30	30	30	30	208
Annual Fill (MMB)					8	12	10				30
Oil Price:											
Nominal Dollars					55.51	60.02	64.65				
Real Dollars					42.48	43.75	45.06				
Oil Cost (in Millions of $)											
Nominal Dollars					444	720	647				1811
Real Dollars					340	525	451				1316
PV in 1981 of Real Dollars					232	326	255				813

TABLE A-10
BUDGET AUTHORITY REQUIREMENTS
750 MMB BASELINE SYSTEM
(BA IN MILLIONS OF DOLLARS)

	Through FY 1980	FY 1981	FY 1982	FY 1983	FY 1984	FY 1985	FY 1986	FY 1987	After FY 1987	TOTAL[1]
500 MMB BASE MODULE										
Planning	48	8	9	9	8	6	6	6		100
Oil Acquisition and Transportation	3,478	3,230[2]	3,684	4,328	2,924	4,348	3,032	111		25,135
Storage Facilities Development	1,396	81	94	161	147	136	108	82		2,206
Program Direction	29	11	12	12	13	13	13	14		118
Subtotal	4,951	3,330	3,799	4,510	3,092	4,503	3,159	213		27,558
30 MMB WEST HACKBERRY COLXPANSION										
Oil Acquisition and Transportation						-1,031	+1,300	+1,254	+641	+2,164
Storage Facilities Development		+1	+3	+30	+13	+13	+15	+17		+96
140 MMB BIG HILL										
Oil Acquisition and Transportation							+420	+3,744	+5,943	+10,107
Storage Facilities Development		+1	+81	+390	+78	+64	+42	+40	+103	+799
TOTAL BASELINE SYSTEM										
Planning	48	8	9	9	8	6	6	6		100
Oil Acquisition and Transportation	3,478	3,230	3,684	4,328	2,924	3,317	4,752	5,109	6,584	37,406
Storage Facilities Development	1,396	83	178	585	238	213	165	139	103	3,100
Program Direction	29	11	12	12	13	13	13	14		118
TOTAL BA[1]	4,951	3,333	3,883	4,933	3,183	3,550	4,935	5,268	6,687	40,724
Outlays	2,413	3,401	3,625	3,845	4,429	2,424	4,947	4,734	10,008	40,626

[1] Totals may not agree with detail due to rounding

[2] Includes $542 million of entitlements

CUMULATIVE FILL CAPACITY
(MMB END OF FISCAL YEAR)

	Through 1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Base Module	250	251	267	343	417	467	563	580	580	580	580
West Hackberry						-11	-25	+18	30	30	30
Big Hill							13	60	140	140	
750 MMB System Total	250	251	267	343	417	456	538	611	670	750	750
Annual Fill (MMB)				76	74	39	82	73	59	80	
Average Daily Fill (MBD)				208	203	107	225	200	162	219	

TABLE A-11
BUDGET AUTHORITY REQUIREMENTS
790 MMB UNDERGROUND SYSTEM
(BA IN MILLIONS OF DOLLARS)

	Through FY 1980	FY 1981	FY 1982	FY 1983	FY 1984	FY 1985	FY 1986	FY 1987	After FY 1987	TOTAL[1]
750 MMB BASELINE SYSTEM (TABLE A-10)	4,951	3,333	3,883	4,933	3,183	3,550	4,935	5,268	6,687	40,724
40 MMB COTE BLANCHE INCREMENT										
Planning										
Oil Acquisition and Transportation					+2,141					+2,141
Storage Facilities Development			+213	+4	+7					+224
Program Direction			+1	+2		+1	+1			+5
TOTAL 790 MMB SYSTEM										
Planning	48	8	9	9	8	6	6	6		100
Oil Acquisition and Storage	3,478	3,230	3,684	4,328	5,065	3,317	4,752	5,109	6,584	39,547
Storage Facilities Development	1,396	83	391	589	245	213	165	139	103	3,324
Program Direction	29	11	13	14	14	14	14	14		123
TOTAL BA[1]	4,951	3,333	4,097	4,939	5,332	3,550	4,936	5,269	6,687	43,094
OUTLAYS	2,413	3,401	3,680	3,952	5,105	3,955	4,947	4,735	10,808	42,995

[1] Totals may not agree with detail due to rounding

CUMULATIVE FILL CAPACITY
(MMB END OF FISCAL YEAR)

	Through 1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
750 MMB Baseline System	250	251	267	343	417	456	538	611	670	750	750
Cote Blanche	—	—	—	—	18	40	40	40	40	40	40
790 MMB System Total	250	251	267	343	435	496	578	651	710	790	790
Annual Fill (MMB)				76	92	61	82	73	59	80	
Average Daily Fill (MBD)				208	252	167	225	200	162	219	

TABLE A-12
BUDGET AUTHORITY REQUIREMENTS
890 MMB MIXED SYSTEM
(BA IN MILLIONS OF DOLLARS)

	Through FY 1980	FY 1981	FY 1982	FY 1983	FY 1984	FY 1985	FY 1986	After FY 1987	FY 1987	TOTAL[1]
790 MMB UNDERGROUND SYSTEM (TABLE A-11)	4,951	3,333	4,097	4,939	5,332	3,550	4,936	5,269	6,687	43,094
100 MMB STEEL TANKS INCREMENT										
Planning			+2	+1						+3
Oil Acquisition and Transportation					+666	+1,746	+2,114	+1,314	+279	+6,119
Storage Facilities Development		+18	+554	+776	+3	+6	+9	+13	+5	+1,384
Program Direction			+1		†	+1	+1	+1	+2	+6
TOTAL 890 MMB MIXED SYSTEM										
Planning	48	8	11	10	8	6	6	6		103
Oil Acquisition and Transportaiton	3,478	3,230	3,684	4,328	5,731	5,063	6,866	6,423	6,863	45,066
Storage Facilities Development	1,396	101	945	1,365	248	219	174	152	108	4,708
Program Direction	29	11	14	14	14	15	15	15	2	129
TOTAL BA[1]	4,951	3,351	4,654	5,716	6,001	5,303	7,060	6,597	6,973	50,606
OUTLAYS	2,413	3,401	3,791	4,013	5,418	5,564	7,315	7,017	11,576	50,507

[1] Totals may not agree with detail due to rounding

CUMULATIVE FILL CAPACITY
(MMB END OF FISCAL YEAR)

	Through 1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
790 MMB System	250	251	267	343	435	496	578	651	710	790	790
100 MMB Steel Tanks	—	—	—	—	—	24	60	92	100	100	100
890 MMB System Total	250	251	267	343	435	520	638	743	810	890	890
Annual Fill (MMB)				76	92	85	118	105	67	80	
Average Daily Fill (MBD)				208	252	233	323	288	184	219	

TABLE A-13
BUDGET AUTHORITY REQUIREMENTS
1,000 MMB MIXED SYSTEM
(BA IN MILLIONS OF DOLLARS)

	Through FY 1980	FY 1981	FY 1982	FY 1983	FY 1984	FY 1985	FY 1986	FY 1987	After FY 1987	TOTAL[1]
890 MMB MIXED SYSTEM (TABLE A-12)	4,951	3,351	4,654	5,716	6,001	5,303	7,060	6,897	6,973	50,606
110 MMB SALT DOME INCREMENT										
Planning			+4	+2	+2	+2	+1	+1	+2	+14
Oil Acquisition and Transportation								+487	+7,936	+8,423
Storage Facilities Development				+66	+145	+397	+202	+60	+179	+1,049
Program Direction				+1	+1	+1	+1	+1	+6	+10
TOTAL 1,000 MMB MIXED SYSTEM										
Planning	48	8	15	12	10	8	7	7	2	117
Oil Acquisition and Transportation	3,478	3,230	3,684	4,328	5,731	5,063	6,866	6,910	14,799	54,089
Storage Facilities Development	1,396	101	945	1,431	393	616	376	212	287	5,757
Program Direction	29	11	14	15	15	16	16	16	7	139
TOTAL BA[1]	4,951	3,351	4,658	5,785	6,149	5,703	7,264	7,146	15,095	60,102
OUTLAYS	2,413	3,401	3,795	4,071	5,552	5,922	7,553	7,103	20,193	60,002

[1] Totals may not agree with detail due to rounding

CUMULATIVE FILL CAPACITY
(MMB END OF FISCAL YEAR)

	Through 1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
890 MMB System	250	251	267	343	435	520	638	743	810	890	890
110 MMB Salt Dome	—	—	—	—	—	—	—	—	14	60	110
1,000 MMB System Total	250	251	267	343	435	520	638	743	824	950	1,000
Annual Fill (MMB)				76	92	85	118	105	81	126	50
Average Daily Fill (MBD)				208	252	233	323	288	216	345	137

TABLE A-14
BUDGET AUTHORITY REQUIREMENTS
1,000 MMB STEEL TANKS SYSTEM
(BA IN MILLIONS OF DOLLARS)

	Through FY 1980	FY 1981	FY 1982	FY 1983	FY 1984	FY 1985	FY 1986	FY 1987	After FY 1987	TOTAL[1]
890 MMB MIXED SYSTEM (TABLE A-12)	4,951	3,351	4,654	5,716	6,001	5,303	7,060	6,597	6,973	50,606
110 MMB STEEL TANKS INCREMENT										
Planning			+3	+2	+2	+2	+1	+1	+2	+13
Oil Acquisition and Transportation						+720	+1,881	+2,345	+2,383	+7,329
Storage Facilities Development			+18	+115	+1,294	+3	+6	+9	+24	+1,469
Program Direction			+1	+1	+1	+1	+1	+1	+3	+9
TOTAL 1000 MMB STEEL TANKS SYSTEM										
Planning	48	8	14	12	10	8	7	7	2	116
Oil Acquisition and Transportation	3,478	3,230	3,684	4,328	5,731	5,783	8,747	8,768	9,246	52,995
Storage Facilities Development	1,396	101	963	1,480	1,542	222	180	161	132	6,177
Program Direction	29	11	15	15	15	16	16	16	5	138
TOTAL BA[1]	4,951	3,351	4,676	5,034	7,298	6,029	8,949	8,953	11,385	59,426
OUTLAYS	2,413	3,401	3,795	4,127	5,538	5,881	9,005	9,562	15,606	59,327

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[1] Total may not agree with detail due to rounding

CUMULATIVE FILL CAPACITY
(MMB END OF FISCAL YEAR)

	Through 1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
890 MMB System	250	251	267	343	435	520	638	743	810	890	890
110 MMB Steel Tanks	—	—	—	—	—	—	24	60	94	110	110
1,000 MMB System Total	250	251	267	343	435	520	662	803	904	1000	1000
Annual Fill (MMB)				76	92	85	142	141	101	96	
Average Daily Fill (MBD)				208	252	233	389	387	277	263	

APPENDIX B
ASSESSMENT OF IMPACT ON MODULE SCHEDULES DUE TO ADMINISTRATIVE REQUIREMENTS

The Strategic Petroleum Reserve Acceleration Report to the Secretary identifies and examines five options for increasing the capacity of the SPR system by 1989 with emphasis on taking steps to increase the near term (mid 80's) protection provided by a Strategic Reserve.

In examining the feasibility of acceleration, it is apparent that there are two major areas of constraint to acceleration even if funding is assumed to be of no concern. One is in the area of technical feasibility; the other is in the area of legal barriers which must be satisfied.

All options presented in this report are technically feasible, have development schedules that maximize all opportunities to accelerate program implementation, and are fully consistant with the plans developed for the strategic deployment of Reserve inventories. In identifying these five options, many other options that had either been considered in the past, or were being currently considered as alternatives were assessed but not presented because they were either technically infeasible, or could not conform to the requirement to develop options that would assure increased capacity over the period of time (through 1989) on which SPR development is focused.

Since the development plans for all five options are at a maximum technical feasibility level, no reengineering of design and construction is seen as a means to significantly contribute to acceleration of the schedule. In the case of legal barriers, however, a close examination of the issues involved indicated that in general, to the maximum possible extent these issues are planned for solution or accomplishment concurrent with the technical design and construction activities. Thus, it impossible to foresee in advance when these requirements, althrough very expensive and time consuming, will impinge on the overall critical path of the option. Thus, the development plans are designed to not only maximize technical feasibility, but to the extent possible to minimize the potential impact of legal and other administrative barriers on the option's development schedule.

However, it needs to be recognized that without a decision to seek in advance of such relief as a Presidential environmental exemption, all schedules are problematic and subject to delay. This is especially true for new developments such as steel tanks and a new solution-mined site, which may engender environmental opposition.

It is also worth noting that the potential advantages provided in Sec. 101(a) and (c) of the Defense Production Act (DPA) have been assessed and the conclusion has been reached that neither offers significant opportunities to overcome the potential generic problems with the supply of long lead time equipment. If a specific issue at a specific time seems capable of resolution by invoking the DPA, then it will be used.

The four major areas of legal or administrative constraints that could affect SPR acceleration are:

- publishing an Environmental Impact Statement,
- negotiating for land acquisition,
- obtaining and utilizing needed environmental permits, and
- executing a business strategy that minimizes procurement time delays.

The following discussion of each of the modules presented in the SPR acceleration report addresses each of these major legal or administrative barriers and discusses the specific plan for minimizing the adverse affect on the acceleration objective. These issues are summarized in Figure B.1: Adminsitrative Barriers to Acceleration - Assessment of Constraints.

Base Module at 580 Million Barrels

This Base Module consists of 250 million barrels of storage capacity completed in Phase 1, 290 million barrels of storage capacity in Phase II which is substantially complete and the acceleration of the 40 million barrels of storage capacity at the Bryan Mound location originally

Figure B.1. Administrative Barriers to Acceleration - Assessment of Constraints

	ENVIRONMENTAL IMPACT STATEMENT	LAND ACQUISITION	PERMITS	BUSINESS STRATEGY
Base Module	No EIS action unaccomplished.	Not applicable to Base Module.	EPA approval required of brine disposal permit to increase average daily rate from 680 MMB to 900 MMB from Bryan Mound. Permit modification applied for in Feb 1981.	No problems foreseen.
West Hackberry (both modules)	Supplement required for Phase III-scheduled for completion Oct 1981. • Not on critical path	Shortest time may begin upon completion of EIS (Oct-81) process requires 1 year. • Not on critical path	Scheduled for acquisition by mid CY 1983. • Not on critical path	No viable method for accelerating the procurement process yields scheduling benefits. • Of minor significance to critical path
Big Hill	Supplement required for Phase III - included in West Hackberry action. • Not on critical path	Shortest time - same time frame as West Hackberry. • Not on critical path	Ample time provided in development plan. No need for waivers anticipated. • Not on critical path	Principal constraints related to tight market conditions. • No significant opportunity to affect critical path
Cote Blanche	Basic EIS published 1977 - supplement expected to require 1 year - waiver saves 5 mos. • Waiver provides no significant opportunity to affect critical path.	Est. begin mid FY 1983. • Critical path unaffected	No brine disposal issue. Other permits seem to be routine. • Not on critical path	Schedule for development is currently at optimum level. No viable method for accelerating the procurement process yields scheduling benefits. • No significant opportunity To affect critical path
New Solution-Mined Site	Basic EIS requires 18 months - 12 months are on critical path. If EIS requirement did not exist, schedule could be reduced by one year.	Condemnation needs 1 year after EIS. Negotiation could be shorter if concurrent with EIS. • Not on critical path	Permits to be sought concurrent with LLE, design, and site development. • Not on critical path	Principal constraint to acceleration of schedule is related to tight market conditions. • No significant opportunity to affect critical path
Tank Farm (systems alternatives 3 and 5)	EIS not in critical path because design process for tank farm can proceed concurrently. • Not on critical path	Not in critical path - EIS and acquisitional land occur concurrent with system design. • Not on critical path	Permits could be difficult with respect to Clean Air Act. Schedule more than 24 months to resolve this problem before permits affect the critical path. • Not on critical path	Design/procurement schedule concurrent with EIS/Land Acq. Schedule. No viable method for accelerating the procurement process yields scheduling benefits. • No significant opportunity to affect critical path

scheduled in Phase III. This acceleration of 40 million barrels of storage capacity is made possible by the change in the EPA brine disposal permit to allow brine discharge from Bryan Mound into the Gulf of Mexico at a daily average rate of 980 million barrels rather than an average daily rate of 680 million barrels. Additionally, pumps are scheduled for installation late in 1981 to achieve this higher rate of leaching. Because of the very advanced state of SPR site development, the only environmental barrier outstanding is the actual approval of the brine disposal permit modification and this is not expected to be a problem. No land acquisition issues remain for the Basic Module and no business strategy problems remain to affect completion according to the accelerated schedule. Of course, delays are possible as a result of EPA monitoring of time discharge pursuant to the issued permit, but such problems cannot presently be predicted, and will have to be dealt with as they develop.

West Hackberry Module (Both Subalternatives)

This acceleration module contemplates the addition of 30 million barrels of storage capacity to the SPR by 1988 with oil fill beginning late in FY 1985. The schedule ~~for~~ developing this module is not jeopardized to any significant degree by problems associated with environmental requirements; the supplement to the EIS for West Hackberry that covers the module is scheduled for completion in October 1981 and the required environmental permits are scheduled for acquisition by mid calendar year 1983. Neither of these requirements presently is on the development plan's critical path. The land acquisition element of this module is scheduled to require one year after the completion of the EIS supplement. This is an optimal land acquisition schedule because for planning purposes it assumes land acquisition by condemnation after negotiations. Even though land acquisition will require one year under condemnation procedures, the land acquisition element is not currently on this module's development plan critical path. Throughout this module's development plan, the critical path is essentially constrained by technical feasibility and the potential impact of tight market conditions on long lead time equipment. Given these conditions, there do not appear to be significant opportunities to improve upon the current development plan's schedule by waiving environmental permits or other requirements relating to procurement.

Big Hill

This module for SPR acceleration involves a site that has not yet been acquired for salt cavern storage development. However, environmental analyses have been completed and a process has been established for selecting an architect/engineer. The environmental impact statement requirements for Big Hill will be met with the completion of the supplement for West Hackberry in October 1981. Land acquisition is scheduled to require one year after the completion of the EIS supplement in October 1981. This time frame does not present a schedule barrier since land acquisition is not on the critical path.

The acquisition of permits is planned to occur concurrent with design and construction and, at the present time, the utilization of permit waivers is not seen as reducing the time required to implement the Big Hill development plan. As was the case in the West Hackberry module, the critical path is essentially tied to technical feasibility, i.e., design, construction, and brine leach rate, with some concern for the impact of tight market conditions on delivery of long lead time equipment.

Cote Blanche

In this module, the Strategic Petroleum Reserve would acquire (with condemnation a serious possibility) an operating salt mine at Cote Blanche, Louisiana. The estimated storage capacity of this mine is 40 million barrels; it offers the prospect of 40 million barrels of additional protection by early in FY 1985. This very fast acceleration module is enhanced by the fact that the basic EIS was in place as of 1977 and only a supplement is required before operations could begin. This is expected to take one year and would occur concurrent with procurement of contractors and equipment. If the requirement for an environmental impact statement supplement were legislatively waived, the schedule could be advanced by five months. The land acquisition process is planned to require one year. This time frame does not present a schedule barrier since land acquisition is not in the critical path. As in the other modules, design and site construction time requirements are the critical path elements. Environmental permits are not expected to be impediments to maximum schedule implementation because the Cote Blanche mine will not require brine disposal. The other permits required are considered routine and capable of being acquired well within the time required for the technical critical path. At this time, it does not seem that the use of sole source procurement procedures could accelerate the development plan significantly. As in the other modules, however there is a possible constraint on the schedule if the tight market conditions adversely affect equipment supply. Thus, it is the tight market rather than the type of procurement procedure used that is seen as being a potential schedule problem.

New Solution-Mined Site

In this module, the Strategic Petroleum Reserve contemplates identifying and acquiring a new site, developing the site, and creating 120 million barrels of storage capacity. Because no site specific cost, design schedule, or environmental analyses have been conducted, the time frames for EIS, land acquisition, permits, and procurement strategy are potentially more significant than in the preceding modules. However, an examination of the development plan for a new salt cavern site shows that the critical path is determined much more by the technical issues of design, construction and rate of leaching than by the administrative/legal issues. A new EIS is expected to require 18 months of which 12 months are on the critical path. If the requirement for an EIS is waived, the schedule for developing the new solution-mined site module would be advanced by approximately one year resulting in completion of planned storage capability one year earlier. Land acquisition is planned to require one year; this time frame does not present a schedule barrier since it is not on the development plan critical path. The permitting process is not on the critical path; it would occur concurrent with the design and site development elements of the development plan. As in the previous modules, the tight market for equipment supply is seen as being a potential threat to the optimal accomplishment of the development plan for the new solution-mined site.

Tank Farms

This module involves an entirely new approach for Strategic Petroleum Reserve storage: storage of very large amounts of oil above the ground. In all other modules and in existing SPR sites, the Reserve oil is held either in underground mines or caverns leached from salt domes. This has not only been less expensive, but it has avoided some real socio-economic problems that are associated with extremely large above ground storage facilities. However, given the initial objective of this report; increase the capacity of the SPR system with emphasis on taking steps to increase near term (mid-80's) protection, steel tanks become a very appropriate option because of relatively fast development feasibility.

The potential environmental barriers associated with this module are significantly greater than those associated with the various underground storage modules. The principal problem would involve the permitting requirements under the Clean Air Act (CAA). In areas of the country where the level of pollutants in the air exceed the national standards under the CAA, no new major emission sources can be constructed unless the facilities use the latest in air pollution control equipment. Further, any increase in pollution resulting from the facility must be offet by a greater reduction in like pollutants from existing facilities. In the past this policy has not been applicable to SPR underground facilities because emissions have not been large enough to have the SPR facilities classified as major emission sources but steel storage tanks may be classified as major emissions sources. As the Government is not now a major source of hydrocarbon emissions in the Gulf, emissions offsets probably would have to be obtained by reducing emissions from private sources. However, while a private storage firm could pay another existing source the cost of installing pollution control equipment in order to obtain the necessary "offsets", the Government is prohibited from paying for improvements to private property absent specific authority from Congress. Thus the CAA could pose a significant problem which must be overcome if steel tanks are to be a viable module.

If program acceleration is considered to be a very high priority, this problem could be overcome by the President exercising his authority to waive the CAA as it applies to the SPR. In addition, should delays in schedule occur because of unexpected problems with the Environmental Impact Statement, relief could be sought by seeking a legislative waiver to the National Environmental Policy Act (NEPA).

In addition to the potential problems with the EIS and permitting process, land acquisition even by condemnation could present significant problems. The problem is that tank farm storage for many millions of barrels of oil is very large and obtrusive. Such an installation or group of installations is likely to meet with significant local resistance. A judicious site selection process could overcome much local opposition but it is appropriate to note that at best, a tank farm is likely to engender local opposition.

Procurement strategy is not seen as a significant problem other than the usual problem with tight market conditions and their potential impact on equipment delivery schedules. Steel tank storage is a familiar storage medium and design can begin at the same time as site selection and environmental impact statement.

Senator WARNER. Would it be possible to commence interim storage activities in fiscal 1982, for example?

Mr. WOOTEN. For interim? These we are talking about for permanent storage.

Senator WARNER. I know, but I am asking you do you think you could do interim?

Mr. WOOTEN. Could we do interim? No; it would take us 14 months to get the first tank ready from the date of start.

Senator WARNER. That was not an option in your area.

Mr. WOOTEN. It is 14 months. If we were to start today in 14 months we could put oil in one tank.

Senator WARNER. Mr. Luciano, executive director, Transportation Institute.

STATEMENT OF PETER LUCIANO, EXECUTIVE DIRECTOR, TRANSPORTATION INSTITUTE, WASHINGTON, D.C.

Mr. LUCIANO. Thank you very much, Mr. Chairman. It is always a pleasure to appear before this committee and we deeply appreciate your willingness to receive our testimony.

The Transportation Institute is a nonprofit organization dedicated to research and education on maritime issues and the importance of America's Merchant Marine. Our 174 member companies operate U.S.-flag vessels in the Nation's foreign and domestic shipping trades. Several of these companies have been engaged in the transportation of oil to the strategic petroleum reserve.

The institute has consistently supported the filling of the SPR. It is in our view the most effective U.S. program to deal with a foreign oil supply disruption. The reserve enhances the Nation's security by providing emergency oil to keep the economy running and by preserving the independence of our foreign policy against the threat of an oil embargo.

It also encourages maintenance and development of a U.S.-flag tanker fleet for carriage of oil in an emergency and for fulfilling the statutory role of naval auxiliary in times of conflict. We are especially concerned with the problem of storage capacity restraints currently plaguing the reserve program. To that end we would advocate the use of interim storage capacity to help bridge the storage capacity gap.

It is unfortunate that as the reserve program has finally become an instrument of U.S. energy policy, the United States may be forced to reduce oil purchases significantly because of storage capacity restraints. With that potential disruption in mind the Transportation Institute commissioned a study by the Petroleum Industry Research Associates, Inc., of New York.

With your permission, I would ask that a copy of the study might be included in the record of these hearings.

Senator WARNER. Without objection.

Mr. LUCIANO. The study evaluated the need for new storage capacity and then reviewed the options available. Three storage types were reviewed, salt domes, steel tank farms and tankers. The cost estimates revealed that salt caverns were the least expensive. Tankers were somewhat more expensive. Building a steel tank farm would be the most expensive, even using generous assumptions.

Based on the results of that study, it is our view that reductions in spending on SPR oil acquisition and program development are not wise. Instead, the United States should continue to stockpile oil using interim storage facilities.

Now, since completion of the study in July of last year, Mr. Chairman, certain market changes have resulted in storage possibilities not considered in the study. It is our understanding that there is a salt dome already constructed which might be available for storage, as well as some excess storage space in onland steel tanks.

Furthermore, with the testimony you have received today, there are other options in the State of Virginia. Based upon this information, we would suggest using the following alternatives as the most cost efficient approach to interim stockpiling. One, alternate salt domes already developed; two, other onland storage available for rental; or, three, existing tankers.

In our testimony today, we would like to provide some additional details with regard to the third option, namely tankers. Japan began storing its strategic oil reserves in tankers in 1979. In Alaska, Japan had 35 vessels in floating storage off its coast.

Private oil companies also use tankers for storage of oil in the short and medium term. Petroleum Intelligence Weekly reported on February 22 of this year that the total tonnage of tankers used for oil storage worldwide was almost 30 million deadweight tons.

As noted in the study referred to above, they offer the advantage of flexibility for interim storage. They are available in abundant supply, can be chartered on flexible terms, can be moved from one location to another.

Tankers would be available for virtually any quantity of oil the United States would want to store. In reviewing the status of the world tanker fleet, Lloyd's Shipping Economist reported in January of this year that there were 80 million deadweight tons available in the large crude carrier categories most suited for storage capacity. Perhaps 80 million deadweight tons of tanker capacity could hold over 600 million barrels of oil if placed in storage.

An additional consideration must be reviewed with regard to the security implications of tanker storage. Under current law a minimum of 50 percent of all foreign oil purchases for SPR must be transported on U.S.-flag vessels. This requirement normally employs most of the suitable U.S.-flag tonnage.

Under an aggressive fill strategy a lack of U.S.-flag vessels to hold oil in storage would probably result in the need to employ foreign-flag tankers, the Transportation Institute endorses such a policy with the following conditions:

One, that U.S.-flag tankers be utilized for interim storage, provided they are available; two, if foreign vessels must be used for interim storage, that they be required to meet all U.S.-flag safety, environmental and operating standards including those required by the U.S. Coast Guard; three, that all individuals operating, controlling or aboard the storage vessels would be required to be U.S. citizens; and, fourth, that storage vessel management would be by United States companies.

These conditions would be necessary to insure the undisputed security and rapid availability of oil stored aboard foreign vessels, we believe.

Another consideration involves the consistency of the fill rate. Without a long-term committed rate of fill, U.S. interests become subject to erratic swings in tactics, both domestically and from foreign sources. With a long-term fill rate clearly mandated by Congress, the United States will be able to assure its energy security and reduce many of the aberations to which this program has been subject over the past half-dozen years.

Given our need and ability to purchase and store oil supplies at this time, the lack of permanent storage capacity should not be a limiting factor for the SPR program. Only a continued, rapid, and regular fill rate will serve the best interests of the United States.

Thank you very much.

[The prepared statement and study submitted by Mr. Luciano follow:]

STATEMENT OF
PETER LUCIANO
EXECUTIVE DIRECTOR
TRANSPORTATION INSTITUTE
BEFORE THE
SENATE COMMITTEE ON ENERGY AND NATURAL RESOURCES
SUBCOMMITTEE ON ENERGY AND MINERAL RESOURCES
MARCH 25, 1982

Mr. Chairman and members of the Subcommittee, my name is Peter Luciano. I am Executive Director of the Transportation Institute.

The Transportation Institute is a nonprofit organization dedicated to research and education on maritime issues and the importance of America's Merchant Marine. Our 174 member companies operate U.S.-flag vessels in the nation's foreign and domestic shipping trades. Several of these companies have been engaged in the transportation of oil to the Strategic Petroleum Reserve (SPR).

The Transportation Institute has consistently supported the filling of the SPR. It is the most effective U.S. program to deal with a foreign oil supply disruption. The Reserve enhances the nation's security by providing emergency oil to keep the economy running and by preserving the independence of our foreign policy against the threat of an oil embargo. It also encourages maintenance and development of a U.S.-flag tanker fleet for carriage of oil in an emergency and for fulfilling the role of naval auxiliary in times of conflict. For these reasons, we support a reserve filled to maximum capacity as rapidly as possible. We are especially concerned with the problem of storage capacity restraints currently plaguing the reserve program. To that end, we would advocate the use of interim storage capacity to help bridge the storage capacity gap.

Since its inception, the SPR program has been continuously disrupted, causing the target date for completion to be moved back to 1989. Initially, technical problems slowed cavern development. When the Reserve finally became operational, very little oil was purchased before the revolution in Iran in 1979 forced a prolonged halt in oil purchases. Finally, in 1980, in large part because of strong Congressional support, the Carter Administration resumed filling the Reserve. Since early 1981, the fill rates have been maintained, yielding now a small reserve, but one capable of supporting the country for over a month, should oil imports be disrupted.

It is unfortunate that, as the reserve program has finally become an instrument of U.S. energy policy, the United States may be forced to reduce oil purchases significantly because of storage capacity restraints. With that potential disruption in mind, the Transportation Institute commissioned a study by Petroleum Industry Research Associates, Inc., of New York. (With your permission, I would ask that a copy of the study might be included in the record of these hearings.) The study evaluated the need for new storage capacity, and then reviewed the options available. Three storage types were reviewed, salt domes, steel tank farms and tankers. The cost estimates revealed:

1) salt caverns were least expensive;
2) tankers were somewhat more expensive;
3) building a steel tank farm would be the most expensive, even using generous assumptions.

Based on the results of that study, it is our view that reductions in spending on SPR oil acquisition and program development are not wise. Instead, the United States should continue to stockpile oil using interim storage facilities.

Since completion of the study in July, 1981, certain market changes have resulted in storage possibilities not considered in the study. It is our understanding that there is a salt dome already constructed which might be available for storage, as well as some excess storage space in on-land steel tanks. Based upon this information, we would suggest using the following alternatives as the most cost-efficient approach to interim stockpiling:

1) alternate salt domes already developed;

2) other on-land storage available for rental; or

3) existing tankers.

These three alternatives may all be used to fill the short-term storage need. For that reason it is important to address operational aspects of the various alternatives. With regard to salt domes or other on-land storage, both options should be explored in effort to obtain suitable storage capacity.

In our role today we would like to provide some additional details with regard to the third option, namely tankers. Use of tankers for oil storage is not a new idea. Japan began storing its strategic oil reserves in tankers in 1979 because it had not yet developed other facilities for storage. At last report, Japan had 35 vessels in floating storage off its coast.

Private oil companies also use tankers for storage of oil in the short and medium term. Petroleum Intelligence Weekly reported on February 22 that the total tonnage of tankers used for oil storage worldwide was almost 30 million deadweight tons (dwt). Of that, more than 10 million was being held in the Gulf of Mexico. Tankers are a feasible and efficient alternative. As noted in the study referred to above, "They offer the advantage of flexibility for interim storage: they are available in abundant supply, can be chartered on flexible terms, can be moved from one location to another...."

Tankers would be available for virtually any quantity of oil the United States would want to store. In reviewing the status of the world tanker fleet, 150,000 dwt vessels and over, Lloyd's Shipping Economist reported in January, 1982, that 27 million dwt were idle, 15 million dwt laid up and another 47 million dwt capacity absorbed in slow steaming. In total there are over 80 million dwt available in the large crude carrier categories most suited for storage capacity. Perhaps 80 million dwt of tanker capacity could hold over 600 million barrels of oil if placed in storage. It is clearly feasible for the United States to meet its entire need for interim storage requirements through charter of tankers.

An additional consideration must be reviewed with regard to the security implications of tanker storage. Under current law a minimum of fifty percent of all foreign oil purchases for SPR must be transported on U.S.-flag vessels. This requirement normally employs most of the suitable U.S.-flag tonnage. Under an aggressive fill strategy a lack of U.S.-flag vessels to hold oil in storage would probably result in the need to employ foreign-flag tankers. The Transportation Institute endorses such a policy with the following conditions:

1) U.S.-flag tankers be utilized for interim storage, provided they are available,

2) if foreign vessels must be used for interim storage, they would be required to meet all U.S.-flag safety, environmental, and operating standards including those required by the United States Coast Guard;

3) all individuals operating, controlling, or aboard the storage vessels would be required to be U.S. citizens; and

4) storage-vessel management would be by United States companies.

These conditions would be necessary to insure the undisputed security and rapid availability of oil stored in the Gulf aboard foreign vessels.

Another consideration involves the consistency of the fill rate. At all levels of planning, storage, transport, and final goals, a consistent target rate-of-fill is important. Planning by all affected parties is enhanced, as are U.S. foreign policy and energy policy objectives. Without a long-term committed rate of fill, U.S. interests become subject to erratic swings in tactics both domestically and from foreign sources. With a long-term fill rate clearly mandated by Congress, the United States will be able to assure its energy security and reduce many of the aberations to which this program has been subject over the past half-dozen years.

At this point, it is important to note the benefits of an accelerated fill of the SPR, especially since interim storage options are viable. First, the more oil in the reserve, the more protection the United States has from unexpected oil supply interruptions. In addition, political power implicit in the use of oil as an economic weapon would diminish, and the temptation to use that weapon would be reduced.

Also, there can be little doubt that the price of oil is now a bargain. While analysts are far from unanimous, there is certainly good reason to expect the current oil glut and price decline to halt and reverse as Western Europe and the United States return to better economic health. The recent unity demonstrated by OPEC nations indicate that group will continue its efforts to reverse recent price declines. The U.S. government should take advantage of the low price and supply availability during this favorable period of market adjustment.

Given our need and ability to purchase and store oil supplies at this time, the lack of permanent storage capacity should not be a limiting factor for the SPR program. Only a continued, rapid, and regular fill rate will serve the best interests of the United States.

Thank you very much.

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THE STRATEGIC PETROLEUM RESERVE:
THE NEED FOR INTERIM STORAGE CAPACITY

Prepared For

The Transportation Institute

July 1981

PIRA

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I. INTRODUCTION AND SUMMARY

A. Introduction

The creation of the Strategic Petroleum Reserve (SPR) was mandated by law in 1975. In the enabling legislation, the Energy Policy and Conservation Act, the Congress stated,

> The Congress finds that the storage of substantial quantities of petroleum products will diminish the vulnerability of the United States to the effects of a severe energy supply interruption, and provide limited protection from the short-term consequences of interruptions in supplies of petroleum products.*

The Congress was not alone in its assessment; the importance of the SPR has been confirmed in government, academic and industry studies. In its report, Emergency Preparedness for Interruption of Petroleum Imports into the United States, the National Petroleum Council summarized the advantages of the SPR succinctly:

> The major advantages of strategic stocks are that they:
> -Are under total control of government, thus enhancing U.S. posture among IEA countries
> -Can be a deterrent to politically inspired disruptions of U.S. imports
> -Reduce panic buying and hoarding which may accompany a disruption
> -Allow additional time for diplomatic and possibly military planning during a major disruption
> -Mitigate the export of wealth which may occur as a result of an imports disruption.**

Further, there is general agreement that the SPR must contain large volumes of oil in order to be effective. Recent examinations of the cost/benefit of the SPR have converged around an estimate of one billion barrels, the volume authorized by law, as the optimal size of the Reserve.

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*P.L. 94-163

**National Petroleum Council, Emergency Preparedness for Interruption of Petroleum Imports into the U.S., April 1981.

In spite of the consensus on the benefits of the SPR, and the consensus on the continued vulnerability of the U.S. to oil supply interruptions, the filling of the SPR has been hindered by technical, financial, political and administrative problems. As now planned, the SPR will have a final capacity to store 750 million barrels, and the facilities for the total volume will not be available until 1989. More importantly, the rate at which oil can be injected into the storage facilities is severely limited by technical factors between mid-1982 and early 1986.

This report is an examination of the need for accelerating the SPR fill rate from the constrained levels prevailing under the current SPR Plan, and an examination of the use of tankers for augmenting storage capacity in the near-term.

B. Summary

- According to most forecasts the U.S. will remain substantially dependent on imported oil supply over the period to 1990. This dependency makes the U.S. and its allies vulnerable to the effects of oil supply disruptions.
- The 1973-74 Arab oil embargo and the market response to the 1979 Iranian export curtailment have had deleterious impacts on the economy, including loss of GNP, loss of productivity, higher inflation rates and lastingly higher energy prices.
- The current SPR Plan, approved by Congress, calls for the development of salt cavern crude oil storage capability totalling 750 million barrels by 1989. Developed in phases, the storage capacity under the completed Phase I is 248 million barrels, Phase II will add 290 million barrels by 1986 and Phase III will add 212 million barrels by 1989. It is not technically or economically feasible to accelerate the preparation of the salt caverns significantly.

- Equally as important as the total volume of storage capacity is the rate at which crude oil can be pumped into the caverns. Because of the development schedule, the maximum fill rate drops substantially in mid-1982, and averages only 130 thousand barrels per day between then and early 1986. For a full year (mid-1984 to mid-1985) cavern capacity is scheduled to be constant; this could drop the fill rate to zero over this period.

- The fill rate constraint results in an insufficient volume of oil actually in storage at any given time during this period:

  -There may be a reluctance to draw on the Reserves if the volumes are low;
  -If the Reserve is drawn upon, it cannot be drawn upon as long or as deeply;
  -Its usefulness as a deterrent to the use of oil as a political weapon is compromised.

- The fill rate limitations, in addition, reduce U.S. flexibility to respond to soft world oil markets, when purchasing for the SPR would have the least disruptive effect and when the SPR could be filled for the lowest oil cost.

- Tankers offer one alternative for augmenting storage capacity in the short term (2 to 5 years). They meet several important criteria:

  -In surplus, they are readily available, and offer a relatively short lag time for implementation of an interim storage program;

  -They are currently used by the oil industry and governments in consuming and producing countries, and thus offer a tested mode of interim storage;

  -Their utilization will not be duplicative of the capital investment already committed for the salt caverns (which have the lowest cost in the long term);

  -Charters can be negotiated ship-by-ship, and thus involve no large scale or inflexible commitment of capital funds and no long term commitment which precludes response to changing circumstances.

- The Japanese use of tankers for interim storage of strategic stocks is perhaps the best known continuing tanker storage program. In April 1981, 6.6 million deadweight tons of tanker capacity were dedicated to oil storage off the Japanese coast. In other areas, the tanker tonnage used for storage varies substantially, reflecting individual company needs. In April 1981, 5.3 million deadweight tons of tanker capacity were being used for storage in areas other than Japan. VLCC's accounted for 72% of the total.

- The cost of storing SPR oil in VLCC's is difficult to quantify without further study. The following factors will have an important influence, and each may be evaluated by individual tanker owners in a different light:

  -The location chosen--protected harbor or open sea;

  -The operating requirements, if any--crew nationality, ship registry, special safety regulations;

  -The vessel configuration--single vessels or groupings;

  -The fuel use and cost;

  -The perceived alternatives for a particular tanker owner's specific vessel--the current and forecast VLCC market, scrapping prices, the vessel's age and condition.

- Steel tanks present another option for interim storage of SPR crude oil. Relative to tankers, they have the following disadvantages:

  -Because only relatively small volumes of existing steel tank capacity, if any, will be available, reliance on steel tanks for interim storage will result in duplicative capital investments (vis-a-vis the salt caverns) for new tank construction;

-The lead time for construction of steel tanks is likely 2-3 years, longer than tanker chartering, making steel tanks less attractive with respect to gleaning the benefits of an accelerated SPR fill rate between mid-'82 and early 1986;

-The cost of steel tank construction, according to one specific proposal, would range from $9.00 to $10.50 per barrel of capacity. Amortized over 5 years and including a 15 percent rate of return, the annualized cost would be $3.20 to $3.69 per barrel of capacity. This estimate is predicated on a 40 million barrel tank farm at the U.S. Gulf Coast, utilizing the salt cavern terminals and pipelines. It is at the lower end of the range of estimates of steel tank construction, and excludes fixed operating costs such as property taxes and insurance.

- Salt caverns present the lowest cost option for long term storage. In order to reduce vulnerability to oil supply disruptions in the short term and to take advantage of world oil market conditions, however, the U.S. will have to consider alternative interim storage mechanisms. Tankers may be the cheaper of the interim storage systems examined in this report, and offer flexibility which steel tanks do not.

II. U.S. OIL IMPORTS AND SECURITY OF SUPPLY

Although dependency on oil imports is unlikely to grow substantially as a share of U.S. oil demand in the coming decade, neither is that dependency going to fall. The vulnerability of the U.S. economy to oil supply disruptions will remain high, therefore. Further, while the total share of oil consumption supplied by all foreign sources may remain stable, the share of imports supplied from politically volatile regions is likely to rise. This section presents a brief overview of historical oil import trends, a summary of several recent forecasts of oil supply and demand, and a discussion of continued vulnerability to oil import interruptions.

A. Historical Trends

The petroleum supply/demand trends of the period 1965-1980 have been analyzed extensively in other studies. Because our readers are likely to be familiar with these trends, we will summarize only the most important factors here. Data for selected years in the period are shown in Table II-1, p. 7.

1. Demand

Total demand for petroleum products (including export demand) grew rapidly in the 1965-1973 period. Its growth was temporarily halted by the 1973/74 OPEC oil price increases and the ensuing economic recession--the worst in the postwar period. In the period 1975-1978, as the economic recovery built strength, demand grew to its peak, 19.2 million barrels per day (MM B/D). Oil consumption in 1979 was constrained by the oil shortages which resulted from the Iranian revolution and the consequent market responses. The oil price increases of 1979 and 1980 continued to dampen demand for oil in 1980, when it equalled 17.6 MM B/D.

TABLE II-1

U.S. PETROLEUM SUPPLY/DEMAND FOR SELECTED YEARS, 1965-1980

(Millions of Barrels per Day)

	Domestic Liquids Production(1)	Total Imports(2)	Total Supply/ Demand(3)	Imports as Share of Total (%)
1965	9.01	2.47	11.71	21.1
1968	10.60	2.84	13.64	20.8
1970	11.30	3.42	14.97	22.8
1973	10.95	6.26	17.55	35.7
1975	10.01	6.06	16.54	36.6
1978	10.27	8.36	19.22	43.5
1980	10.16	6.79	17.59	38.6

(1) Crude oil, lease condensate, natural gas liquids.

(2) Crude oil and petroleum products. Includes crude oil imports for the Strategic Petroleum Reserve: 1978, 0.16; 1980, 0.04; other years, none.

(3) Includes processing gain, unaccounted for crude oil, stock changes, and export demand.

Source: U.S. Department of Energy, Energy Information Administration, 1980 Annual Report to Congress, Vol. 2: Data, March 1981. Data for 1980 are preliminary.

2. Domestic Production

Indigenous production of petroleum liquids peaked in 1970, at 11.3 MM B/D. While the introduction of Alaskan North Slope crude oil increased production temporarily in 1977 and 1978, domestic liquids production fell in 1979 and remained stable in 1980, at approximately 10.2 MM B/D.

3. Oil Imports

Although total oil imports grew in the period 1965-1970, crude oil imports were relatively unchanged, due to government prohibitions. Product imports, mostly residual fuel oil (which was not subject to the government's volumetric quota), were largely responsible for the increase. Easing (and, in 1973, elimination) of the volumetric quota on crude oil imports, combined with the higher demand and lower domestic production, caused crude oil imports to quadruple between 1970 and their peak in 1977. Product imports fell from 1973 to 1980. When total imports were at their peak in 1977, they accounted for 47 percent of total petroleum supplies. In 1980, they accounted for 39 percent.

These historical trends give an indication of the current situation and must be used as a backdrop for assessing the U.S. response to recent supply interruptions (see pp.15 to 20).

B. Forecasts

In assessing the need for an accelerated SPR fill rate, one must examine future supply and demand trends, both in the next few years and in the longer term. In Table II-2 we have assembled the U.S. petroleum supply/demand forecasts of several organizations. The demand for petroleum in 1985, according to these forecasts, will range from 14.7 to 17.6 MM B/D. The low figure, estimated by the Department of Energy, is a high oil

TABLE II-2

SELECTED FORECASTS OF U.S. PETROLEUM SUPPLY/DEMAND

(Millions of Barrels Per Day)

Source:	1980 (Actual)	1985	1990
Exxon			
Domestic Liquids Supply	10.2		7.8
Imports	6.8	NA	8.8
Total Supply/Demand	17.6		16.8
Shell			
Domestic Liquids Supply	10.2	8.5-9.0	8.5-9.0
Imports	6.8	8.7-8.2	8.7-8.2
Total Supply/Demand	17.6	17.2	17.2
Department of Energy			
Domestic Liquids Supply	10.2	9.3- 9.6	9.1-10.0
Imports	6.8	6.2- 4.9	6.9- 4.3
Total Supply/Demand	17.6	15.9-14.8	16.4-14.6
Conoco			
Domestic Liquids Supply	10.2		9.6
Imports	6.8	NA	7.1
Total Supply/Demand	17.6		17.2
National Petroleum Council			
Domestic Liquids Supply	10.2	9.4	9.0
Imports	6.8	7.7	7.5
Total Supply/Demand	17.6	17.6	17.0
PIRA			
Domestic Liquids Supply	10.2	9.4	9.5
Imports	6.8	6.9	5.9
Total Supply/Demand	17.6	16.8	16.1

Notes: Domestic Liquids Supply includes crude oil, lease condensate and natural gas liquids production; synthetic fuels, if any; excludes processing gain, if specified.

Total Supply/Demand includes processing gain and export demand, if specified. Figures may not add to Total because processing gain has not been included in components.

Sources: Exxon Company U.S.A, Energy Outlook 1980-2000, December 1980.
Shell Oil, The National Energy Outlook 1980-1990, August 1980.
Energy Information Administration of the U.S. Department of Energy, 1980 Annual Report to Congress, Volume Three: Forecasts, April 1981.
Conoco Inc., World Energy Outlook Through 1990, December 1980.
National Petroleum Council, Refinery Flexibility, December 1980. Only the "low case" is reported here; other demand cases were prepared prior to the price increases of 1979.
PIRA, unpublished estimate.

price case. The high figure, from the National Petroleum Council, is the earliest of the forecasts, completed in early 1980 (but published in late 1980). The timing is significant, because virtually all forecasters have reduced their projected 1985 demand in the last 12 months. Even this highest 1985 estimate, however, shows no demand growth from the 1980 level. The 1990 demand forecasts, in general, show no growth or continued declines in the second half of the 1980's.

For most forecasters, import requirements are calculated as the difference between projected demand and projected domestic supplies (including any synthetic liquids). In our selected array of forecasts, import dependency estimates range from 50 percent (Shell) to 33 percent (Department of Energy) of total 1985 petroleum supply, and from 52 percent (Exxon)to 29 percent (Department of Energy) of total 1990 petroleum supply. U.S. reliance on petroleum imports, therefore, is likely to remain significant throughout the 1980's. More importantly, however, the wide range of import dependency projections indicates the lack of consensus among experts. This uncertainty, in itself, increases potential U.S. vulnerability to future oil supply interruptions.

C. Sources of Import Supply

In the period 1965-1980, the relative dependence of the U.S. on different regions for import supplies has shifted considerably. In the early part of the period, Western Hemisphere sources enjoyed favored status under the volumetric quota system. In addition, imports of products were a larger share of the total foreign supply, and the predominant product import was residual fuel oil from Western Hemisphere (mostly Caribbean) sources. The elimination of the quota program, the increased need for light, low sulfur crude oil refinery feedstocks, and the declining domestic crude oil production all coincided, however, to increase U.S. dependence on African and Middle Eastern sources. Further, recently declining residual fuel oil demand and, until early 1981, U.S. crude oil price controls, contributed to a reduction in product imports. Table II-3 summarizes import sources of supply.

In the decade of the 1980's, the U.S. will remain substantially dependent on Middle Eastern-type crude oils. Modifications to U.S. refineries will markedly reduce U.S. dependence on sweet crude oils. The investments in capacity configuration changes have been dictated by the shifting product mix which will constitute demand for petroleum, the outlook for the long-term availability of the higher quality crude oil (based on reserve estimates) and the price differential which has prevailed between the sweet and sour crude oils over the last several years.

Among traditional Western Hemisphere sources, Mexico expects to increase its crude oil exports, and both Venezuela and Canada are undertaking large investments to increase their production. The volume and timing of the availability of the

TABLE II-3

SOURCES OF PETROLEUM IMPORTS, SHARES BY REGIONS FOR SELECTED YEARS, 1965-1980

	Western Hemisphere (%)	Africa (%)	Middle East (%)	All Others (%)	Total Imports (%)	Total Import Volume (M B/D)
U.S. Crude Oil Imports, Shares by Region						
1965	62.7	5.4	27.0	4.9	100.0	1,238
1968	66.9	12.2	15.3	5.6	100.0	1,291
1970	72.7	9.2	12.8	5.3	100.0	1,324
1973	45.0	24.1	24.7	6.2	100.0	3,244
1975	30.3	32.6	27.3	9.8	100.0	4,104
1978*	14.9	35.8	35.9	13.4	100.0	6,356
1980*	19.7	37.9	29.2	13.1	100.0	5,220
U.S. Total Petroleum Imports, Shares by Region						
1965	79.7	2.7	13.5	4.1	100.0	2,468
1968	79.7	5.5	6.9	7.8	100.0	2,840
1970	83.5	3.6	5.0	7.9	100.0	3,419
1973	64.0	12.5	12.8	10.7	100.0	6,256
1975	48.7	22.1	18.5	10.7	100.0	6,056
1978*	32.3	26.5	27.3	15.1	100.0	8,363
1980*	34.8	27.6	22.1	15.5	100.0	6,789

*Includes crude oil imports to the Strategic Petroleum Reserve

Source: 1969-1978: American Petroleum Institute, Basic Petroleum Data Book (compilations of U.S. Bureau of Mines and Department of Energy data); 1980: U.S. Department of Energy.

increased supply is debatable. An examination of proved reserves by region, as shown in Table II-4, indicates that Middle Eastern crude oils are likely to be the most prevalent in world oil markets. The region holds 56% of the world's proved oil reserves, and at 1980 production rates, has a reserves-to-production ratio more than twice that of any other region. Furthermore, the global interdependence of petroleum markets makes the U.S. vulnerable to supply cutoffs from regions it may not purchase from directly.

TABLE II-4

PROVED OIL RESERVES, BY REGION

	Proved Reserves 1/1/81 (Billion Barrels)	Regional Shares (%)	Reserves to Production Ratio*
Non-Communist			
Asia Pacific	19.6	3.0	19.7
Western Europe	23.1	3.6	25.8
Middle East	362.1	55.8	54.4
Africa	55.1	8.5	25.1
Western Hemisphere	102.3	15.8	17.8
Total Non-Communist	562.2	86.7	34.1
Communist	86.3	13.3	16.2
Total World	648.5	100.0	30.2

*Years of production at 1980 rates

Source: Oil & Gas Journal

III. THE IMPACT OF OIL SUPPLY INTERRUPTIONS

The forecasts of petroleum supply/demand shown in the previous section are based on "business-as-usual" scenarios: they assume no politically imposed or other exogenous supply reductions. In our view, and in the opinion of many other experts, the low forecast demand will dampen price increases in the 1980's; there is no global resource constraint. In the event of a supply disruption, however, prices would likely rise substantially, as they have during other interruptions, and remain high after the petroleum market has attained a new equilibrium.

The possibility of a supply interruption, particularly in Eastern Hemisphere supplies such as those from the Middle East or Libya, is high. At this writing, Iran and Iraq are at war and Syria and Israel are holding on to a most tenuous peace. The region is politically volatile and will likely remain so. Therefore, no observer of oil markets dismisses the possibility of an interruption in the flow of Middle Eastern oil, nor the possibility of oil supply disruptions for other reasons. In its report, The Geopolitics of Oil, the staff of the Senate Committee on Energy and Natural Resources stated:

> The United States and our allies are likely to experience at least two more decades of vulnerability to supply disruptions, political manipulation of oil supplies, and periods of panic buying on the spot market.*

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*Committee on Energy and Natural Resources, United States Senate Staff Report, The Geopolitics of Oil, December 1980.

So long as the U.S. remains substantially dependent on oil imports, it must take steps to reduce its vulnerability to the effects of unpredictable supply cutoffs. Military and defense vulnerability is only one of the effects, albeit a direct and critical one. Also important are the economic impacts, such as:

- An export of wealth as oil prices rise, both during the interruption and after it;
- A GNP loss, due both to the physical unavailability of oil and the accompanying higher prices; and
- Concomitant ripple effects on the economy, such as higher unemployment rates and higher inflation rates.

This list is by no means exhaustive, but merely illustrative. This section presents a brief overview of the effect of previous supply interruptions.

Since the mid-1960's, several incidents have disrupted the flow of foreign oil to Western markets. As a consequence of the 1967 Arab/Israeli war the Arab countries halted oil exports to the U.S. At the time U.S. dependence on Arab oil was limited and the embargo failed to achieve the desired results. The civil war in Nigeria during the late 1960's halted production from this African country for several years. However, at the time world supplies were in surplus, and the loss of Nigerian production had little impact on oil markets.

More recently, interruptions in world oil supplies have exerted a significant impact on petroleum prices and economic activities in the industrialized countries. In October 1973, during the Arab/Israeli conflict, the Organization of Arab Petroleum Exporting Countries (OAPEC) embargoed shipments of petroleum to the U.S. and the Netherlands, two supporters of Israel. At the same time, OAPEC reduced its production, creating a shortage in order to discourage other nations from selling oil to the targets of the boycott. At approximately the same time, OPEC for the first time asserted its pricing power, unilaterally raising the cost of its marker crude by some $2/bbl or 70 percent. In the shortage situation, there was no significant buyer resistance to the increase. In December, furthermore, OPEC raised the marker crude price again, by approximately 150 percent.

Because of the oil already on the high seas, the embargo had only a small impact on U.S. supplies in its early stages. By its later stages (it ended March 1974), the embargo's impact had been softened by "leaks" of supplies to the U.S. In the interim, however, the U.S. had experienced a reduction in imports of 2 MM B/D for 19 weeks, according to the Federal Energy Administration.* World oil prices had nearly tripled. The payments for imported petroleum rose from $8.2 billion in 1973 to $25.5 billion in 1974. GNP is estimated to have dropped by $35-$45 billion from the level which would have prevailed, with some $10-$20 billion of the loss attributable directly to the embargo.** The change in the GNP price deflator rose by more than 3 percentage points from the rate

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*Predecessor agency to the Department of Energy. Federal Energy Administration, Strategic Petroleum Reserve Plan (Energy Action No. 10), February 16, 1977.

**Ibid.

which had been experienced in the immediately preceding years. The price of heating oil rose by 55 percent between the Fall of 1973 and the Spring of 1974. These consequences remained after the end of the embargo, affecting all segments as they rippled through the economy.

In the years following the Arab oil embargo, real prices of oil in world markets declined somewhat, but remained far higher than the pre-embargo level. From 1975 to 1978, world oil supplies were plentiful. Small discounts to government official sales prices were not uncommon in the latter part of the period, particularly for the high quality African crude oils. By the end of 1978, the unusually high 1977 inventory levels in the U.S. had been substantially reduced, and demand, which hit a record volume in 1978, was continuing to grow.

Thus, when the Iranian revolution caused a cessation of Iran's oil exports in December 1978, energy markets were ill-equipped to manage the shortfall. In September 1978, Iranian crude oil exports were approximately 5.5 MM B/D--more than 10 percent of non-Communist world supplies. The civil upheaval preceding the Shah's departure from Iran curtailed production and exports throughout the fourth quarter. Spot prices, which had been lower than official sales prices, began to rise. Throughout the first and second quarters of 1979, uncertainty led to panic buying and conservative inventory management on a world-wide scale, driving spot prices still higher. Some countries and companies had a disproportionately high dependence on Iranian supplies. Unlike the period of the Arab oil embargo, when major international oil companies allocated available supplies throughout their own systems and to their third party customers, during the Spring of 1979, the major companies reduced (or announced the scheduled reduction of) third party sales. The Japanese, for instance, were particularly affected by these developments. An additional factor was the high dependence of some companies, including some U.S. companies, on spot market supplies. Having taken advantage of spot price discounts in 1978, these companies were obligated to continue to fill their needs on the spot market in 1979.*

In 1979, OPEC official sales prices were scheduled to rise in quarterly increments averaging 10 percent over the year and equalling 14.5 percent from end-78 to end-79. The scheduled fourth quarter price had been reached by April; by December 1979 these increases from December 1978 prices had ballooned to 115 percent for African oil, 105 percent for most Middle Eastern sour crudes, and nearly 90 percent for Arabian Light.

The spot price has been a precursor to the official sales price, and the link was clearly demonstrated during 1979. According to Phillip K. Verleger of Yale University, for instance, a $1.00 increase in spot crude oil prices leads to a $0.40-$0.45/bbl increase in official sales prices in the following quarter.* Dr. Verleger states, "The implication is, then, that to the extent that increases in spot prices can be prevented, there will be real, measurable benefits to consumers."**

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*The dependence of the U.S. on spot markets during this period has been documented elsewhere. See, for instance, U.S. Office of the Comptroller General, General Accounting Office, "U.S. Exerts Limited Influence on the International Crude Oil Spot Market," EMD-80-98.

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*Phillip K. Verleger, Jr., "The Relationship Between Spot and Contract Crude Oil Prices," (Draft), October 1980. Cited by the author's permission.

**Ibid.

IV. THE STATUS OF THE STRATEGIC PETROLEUM RESERVE

The need for a Strategic Petroleum Reserve has been discussed since the early 1970's, even before the Arab oil embargo demonstrated the cost of vulnerability to import interruptions. In the numerous examinations of the need for an SPR and its optimal size, there has been a trend toward larger estimates of the SPR's optimal size, now converging at 750 million to 1 billion barrels in more recent studies (see Table IV-1). The SPR's effectiveness is generally agreed to be dependent on its size at any given time; the earlier the optimal volume of oil can be stored, the less vulnerable the U.S. will be to supply cutoffs.

The creation of a Strategic Petroleum Reserve was mandated by law in 1975, authorized to contain 1 billion barrels of oil. Under current plans, the SPR system will have storage capacity for 750 MM bbls of crude oil by the second calendar quarter of 1989. No plans currently exist to store the additional 250 MM bbls allowed under law.

Development of the SPR has been much slower than intended; the Reserve contained only 108 MM bbls in December 1980, rather than the end-1980 target volume of 500 MM bbls established in 1977. As of now, funding for oil purchases to fill the SPR for the year beginning October 1, 1981 remains somewhat uncertain.

This section presents an overview of the SPR program from its inception to its current scheduled development through mid-1989.

A. Legislative and Administrative History

Creation of an SPR was mandated by the Energy Policy and Conservation Act of 1975 (EPCA, P.L. 94-163) to mitigate the effect

TABLE IV-1

SPR SIZE STUDIES

Study Sponsor/Author	Year Completed	Recommended Size (Million Barrels)
Petroleum Industry Research Foundation Studies	1973	550
National Petroleum Council	1974	540
National Petroleum Council	1975	500
Federal Energy Administration	1975	300
Strategic Petroleum Reserve Office	1975	530
Stanford Research Institute	1975	770
Office of Technology Assessment	1975	250-500
Federal Energy Administration	1976	530+
Strategic Petroleum Reserve Office	1976	750
Egon Balas, Carnegie-Mellon University	1976	750
Congressional Budget Office	1976	No Conclusions
Arthur D. Little, Inc.	1976	1,000
Strategic Petroleum Reserve Plan	1976	500
Strategic Petroleum Reserve Office	1977	750+
George C. Sponsler, International Planning Management Corporation	1978	1,000+
Department of Energy	1978	860+
Thomas J. Teisberg, Massachusetts Institute of Technology	1979	1,000
Stanford University	1979	900
Department of Energy	1979	750
Congressional Budget Office*	1980	1,000

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*For CBO policy specific SPR size was not recommended, but report indicates that a 1 billion barrel SPR would be of significant benefit to the nation.

Source: National Petroleum Council, Emergency Preparedness for Interruption of Petroleum Imports into the United States, April 1981.

of oil import disruptions. EPCA authorized a government-owned reserve, an industry-owned reserve, and a regional reserve (designed for particularly import-dependent areas). Only the centrally located government-owned reserve has been implemented. It contains only crude oil.

The initial plan for implementation of the Congressional mandate for a SPR called for storage of 500 MM bbls by December 1982. The plan was later amended to provide for storage of 250 MM bbls by December 1978 and 500 MM bbls by December 1980 (neither goal was met). The plan currently calls for the development of a total of 750 MM bbls of storage capacity.

As shown in Table IV-2, deliveries into the SPR began in late 1977. They ceased in mid-1979, in response to the price rises and chaotic oil markets following the Iranian revolution. In mid-1980, Congress mandated that they begin again, on October 1, 1980, at a minimum rate of 100 M B/D. Production from the government-owned Naval Petroleum Reserve No. 1 (Elk Hills) was required to be set aside for this purpose. A further Congressional action required the Secretary of Energy to attempt a higher fill rate, up to 300 M B/D, or to utilize all the monies appropriated.* Only the 100 M B/D rate is mandated on a continuing basis, however.

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*The Department of Interior and Related Agencies Appropriations Act for the Fiscal Year ending September 30, 1981 (P.L. 96-514) states: "The President shall immediately seek to undertake, and thereafter continue, crude oil acquisition, transportation, and injection activities at a level sufficient to assure that crude oil storage in the SPR will be increased to an average annual rate of at least 300,000 barrels per day or a sustained average annual daily rate of fill which would fully utilize appropriated funds."

TABLE IV-2

CRUDE OIL DELIVERIES INTO THE STRATEGIC PETROLEUM RESERVE

(M B/D)

	1977	1978	1979	1980
January	-	114	204	-
February	-	109	179	-
March	-	132	122	-
April	-	108	66	-
May	-	133	97	-
June	-	146	65	-
July	-	154	41	-
August	-	184	35	-
September	-	225	-	54
October	93	195	-	131
November	73	188	-	142
December	79	245	-	198
Oil in Storage as of December 31, in MM Bbls	7,826	66,860	99,191	107,800

Source: Department of Energy

B. Facilities

The SPR crude oil is stored in salt domes at the U.S. Gulf Coast. The domes are natural structures and have been leached out by "solution mining"; water pumped into the dome is pumped out as brine, leaving a cavern. The storage capacity is being developed in phases. Phase I capacity is complete at 248 MM bbls; the Phase II capacity addition is projected to be 290 MM bbls, scheduled for completion in 1987; Phase III capacity will add 212 MM bbls, completed in 1989, for the 750 MM bbl capacity total. Drawdown capabilities are currently 1.7 MM B/D. Under Phase II, these rates will rise to 3.5 MM B/D, and Phase III will add another 0.9 MM B/D, for a total of 4.5 MM B/D by 1989. The tables and the map on the next pages summarize the site characteristics, storage capacities, and drawdown rates.

In examining the availability of the SPR during an oil supply disruption, several constraints should be noted.

- The maximum drawdown rate of 4.5 MM B/D could be sustained only for slightly over two months; after four months the sustainable rates fall very sharply. (See Figure IV-2.)
- At a fill rate as high as 300 M B/D, the system would encounter a capacity contraint by mid-1982. (See Figure IV-3.)
- For a full year (2nd half of 1984 through the 1st half of 1985), capacity is constant. If the volume stored at the outset of this period were at or near capacity, no additional fill would be possible. (See Table IV-3.)
- The structural integrity of the salt domes is threatened after five fill-withdrawal-fill cycles, because more salt is leached out with each successive procedure.

TABLE IV-3

SPR STORAGE AVAILABILITY

Quarter/Year	Cumulative Storage Capacity (Million Barrels) Total SPR	Phase I	Phase II	Phase III
4Q 1980	248.0	248.0	--	--
1Q 1981			--	--
2Q			--	--
3Q			--	--
4Q			--	--
1Q 1982	↓		--	--
2Q	249.9		1.9	--
3Q	261.1		13.1	--
4Q	272.4		24.4	--
1Q 1983	286.2		38.2	--
2Q	307.7		59.7	--
3Q	330.7		82.7	--
4Q	356.2		108.2	--
1Q 1984	369.0		121.0	--
2Q	394.7		146.7	--
3Q	398.0		150.0	--
4Q	398.0			--
1Q 1985	398.0			--
2Q	398.0		↓	--
3Q	409.2		156.7	4.5
4Q	420.5		163.5	9.0
1Q 1986	431.7		170.2	13.5
2Q	453.0		184.3	20.7
3Q	480.9		202.5	30.4
4Q	508.8		220.7	40.1
1Q 1987	536.6		238.9	49.8
2Q	564.5		257.1	59.4
3Q	605.4		274.5	82.9
4Q	636.3		286.0	102.3
1Q 1988	656.9		290.0	118.9
2Q	672.0			134.0
3Q	687.1			149.1
4Q	705.3			167.3
1Q 1989	730.5			192.5
2Q	750.0	↓	↓	212.0
Total System	750.0	248.0	290.0	212.0

Source: National Petroleum Council, Emergency Preparedness for Interruption of Petroleum Imports into the United States, April 1981.

TABLE IV-4

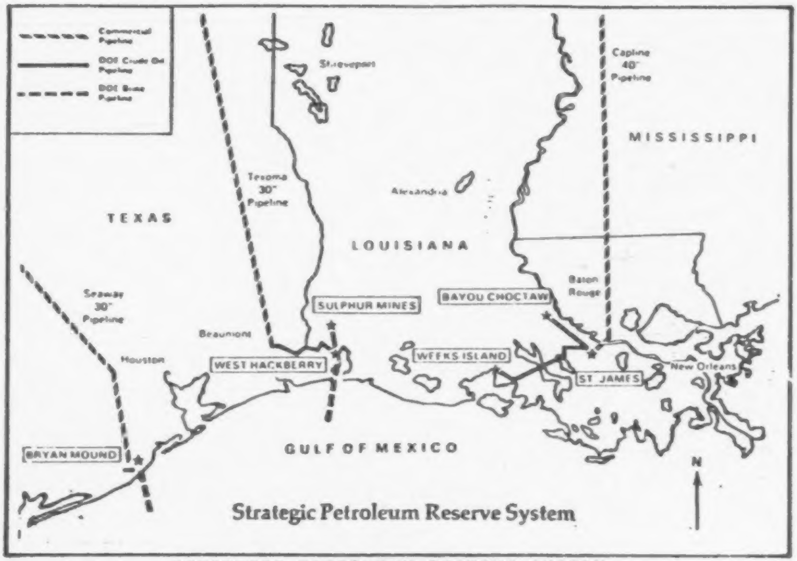
SPR STORAGE SITES AND PROJECTED CAPACITIES

	Phase I		Phase II			Phase III		
Storage Site	Storage Capacity (MM Bbls)	Drawdown Capacity (M B/D)	Incremental Storage Capacity (MM Bbls)	Cumulative Storage Capacity (MM Bbls)	Cumulative Drawdown Capacity (M B/D)	Incremental Storage Capacity (MM Bbls)	Cumulative Storage Capacity (MM Bbls)	Cumulative Drawdown Capacity (M B/D)
Bryan Mound	60	387	120	180	1,054	40	220	1,054
West Hackberry	51	402	160	211	1,402**	30	241	1,402**
Bayou Choctaw	36	240	10	46	480	-	46	480
Weeks Island	*75	590	-	75	590	-	75	590
Sulphur Mines	22	100	-	22	**	-	22	**
New Site	-	-	-	-	-	140	140	935
Subtotal	244	1,719	290	534	3,526	212**	744	4,461
Tanks and Pipelines	4	-		4	-		4	
Total	248	1,719		538	3,526		750***	4,461

*Actual
**Combined drawdown rate, West Hackberry and Sulphur Mines
***Rounded up

Source: National Petroleum Council, Emergency Preparedness for Interruption of Petroleum Imports into the United States, April 1981.

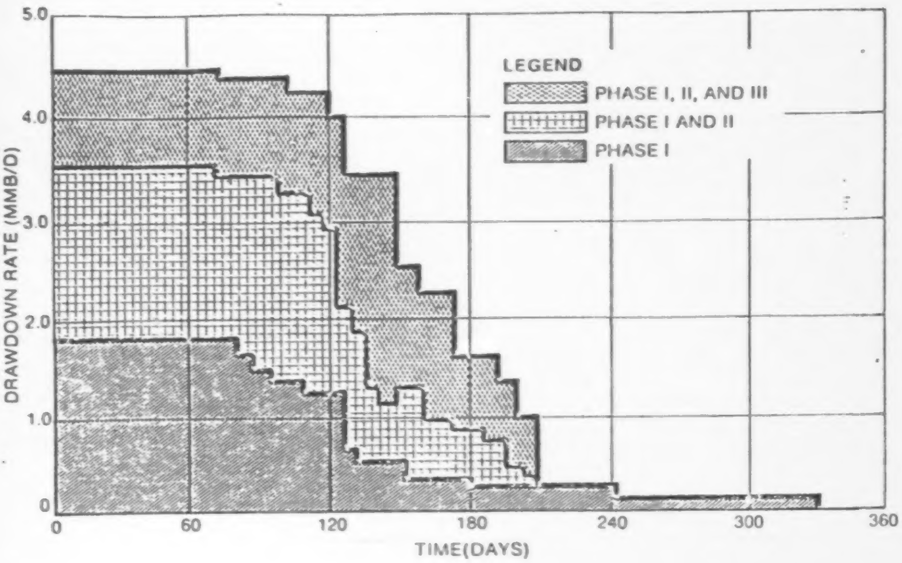
FIGURE IV-1


Commercial Pipeline
DOE Crude Oil Pipeline
DOE Brine Pipeline
Shreveport
Capline 40" Pipeline
MISSISSIPPI
Texoma 30" Pipeline
Alexandria
TEXAS
LOUISIANA
Seaway 30" Pipeline
SULPHUR MINES
BAYOU CHOCTAW
Baton Rouge
Beaumont
Houston
WEST HACKBERRY
WEEKS ISLAND
ST. JAMES
New Orleans
BRYAN MOUND
GULF OF MEXICO
N
Strategic Petroleum Reserve System

STRATEGIC PETROLEUM RESERVE SYSTEM
SITE COMPLEXES AND PIPELINE CONNECTIONS

Source: U.S. Department of Energy, Strategic Petroleum Reserve, Annual Report, February 16, 1981.

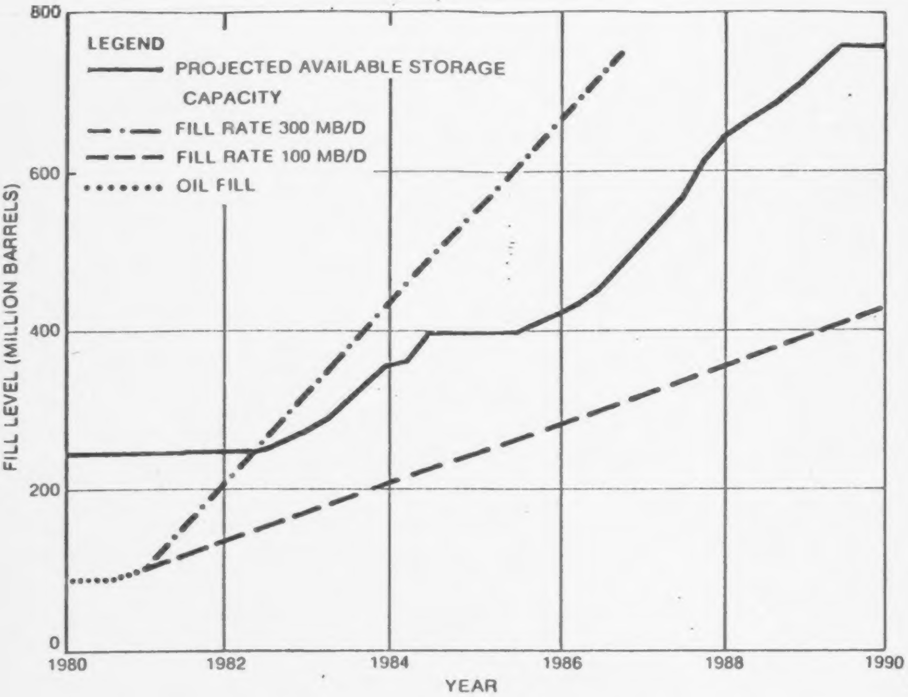
FIGURE IV-2



SPR DRAWDOWN CAPABILITIES
AT SYSTEM COMPLETION, BY PHASE

Source: National Petroleum Council, Emergency Preparedness for Interruption of Petroleum Imports into the United States, April 1981.

FIGURE IV-3



ALTERNATIVE SPR FILL RATES

Source: National Petroleum Council, Emergency Preparedness for Interruption of Petroleum Imports into the United States, April 1981.

C. Cost

The estimated facilities cost is presented in the Department of Energy's most recent SPR Annual Report. Phase I facilities cost amounted to $876 million and the construction cost per barrel averaged $3.53 per barrel (see Table IV-5). Estimated construction cost per barrel for Phase II is $2.42 per barrel and $4.77 per barrel for Phase III.

TABLE IV-5

ESTIMATED FACILITIES DEVELOPMENT COSTS

(Costs are in Then Year Dollars)

Site	Capacity (Millions of Barrels)	Facilities Cost ($ Millions)	Construction Cost per Barrel ($ Per Barrel)
Phase I			
Bryan Mound	60	116.4	1.94
West Hackberry	51	171.6	3.37
Bayou Choctaw	36	136.1	3.78
Weeks Island	75	195.8	2.61
Sulphur Mines	22	67.6	3.07
Pipelines and tanks	4	NA	-
St. James Terminal	NA	99.4	-
New Orleans Project Office	NA	69.0	-
Withdrawal Engineering	NA	20.0	-
Subtotal	248	875.9	3.53
Phase II			
Bryan Mound	120	243.7	2.03
West Hackberry	160	374.0	2.34
Bayou Choctaw	10	28.8	2.88
New Orleans Project Office	NA	55.8	-
Subtotal	290	702.3	2.42
Phase III			
Bryan Mound	40	117.3	2.93
West Hackberry	30	74.7	2.49
New Site	140	819.2	5.85
Pipelines and Tanks	2	-	-
Subtotal	212	1,011.2	4.77
Total	750	2,589.4	3.45

Source: Department of Energy, Strategic Petroleum Reserve, Annual Report, February 16, 1981.

The variation in SPR cost per barrel reflects the methods used to expand storage capacity in each phase. Phase I capacity was developed by acquisition of existing salt caverns and required the installation of terminals, pumps, pipelines, and associated infrastructure.

Phase II capacity is being expanded by solution mining at existing sites. Solution mining is an extremely efficient, low-cost method of developing storage capacity. SPR estimates that the 290 million barrels of Phase II capacity will cost $702 million or $2.42 per barrel. The primary limitation associated with solution mining is the considerable time required to develop capacity.

Phase III capacity is to be developed by solution mining at existing sites and the acquisition of a new site. Cost estimates for the Phase III solution mining at existing sites is $2.50 to $3.00 per barrel of storage capacity. The new site addition is expected to cost approximately $6 per barrel of storage capacity.

D. SPR Crude Oil Quality

The SPR is to be filled with crude oil which can be processed in a wide variety of U.S. refineries. The acceptable grades range from 26^0 API to 41^0 API and from 0.25% sulfur to 1.99% sulfur. See Table IV-6 for a summary of the specifications. As of December 1980, 54 percent of the crude oil held in the SPR was sour. Only one of the SPR sites (West Hackberry) is taking deliveries of both sweet and sour crude. SPR crude Type VI, shown in Table IV-6, is essentially Alaskan North Slope oil. This crude has been stored in the Weeks Island facility. Table IV-7 shows the December 1980 inventories by sulfur content range, and Table IV-8 shows the source of origin of SPR crudes.

TABLE IV-6

CURRENT SPR CRUDE OIL SPECIFICATIONS

Characteristic	SPR Crude Oil Types					
	I	II	III	IV	V	VI
API Gravity (°API)	30-36	40-45	30-36	34-40	36-41	26-30
Total Sulfur (Wt %), Max.	1.99	0.25	0.50	0.25	0.50	1.25
Pour Point (°F), Max.	50	50	50	50	50	50
Salt Content (lb/1,000 bbl), Max.	50	50	50	50	50	50
Viscosity (SUS @ 60°F), Max.	150	150	150	150	150	200
Reid Vapor Pressure (psig @ 100°F), Max.	11	11	11	11	11	11
Mercaptans (ppm in 375°-500°F Fraction), Max.	No Limit	12	12	12	No Limit	12
Water and Sediment (Vol %), Max.	1.0	1.0	1.0	1.0	1.0	1.0
Yields (Vol %)						
Naphtha (<375°F)	24-30	35-42	21-29	29-36	30-38	15-20
Distillate (375°-620°F)	17-31	21-35	23-37	31-45	19-33	24-27
Gas Oil (620°-1,050°F)	26-38	20-34	28-42	20-34	23-37	38-42
Residuum (>1,050°F)	10-19	4-9	7-14	0-5	7-14	15-20

Source: U.S. Department of Energy, Strategic Petroleum Reserve, Annual Report. February 16, 1981.

TABLE IV-7

SPR INVENTORY AS OF DECEMBER 1980

Storage Site	Storage Capacity (Million Barrels)	1980 Cumulative Crude Oil Inventory (Million Barrels) Sour*	Sweet+	Total
Bryan Mound	60	-	38.4	38.4
West Hackberry	51	27.5	10.5	38.0
Bayou Choctaw	36	25.2	-	25.2
Weeks Island	75	4.3	-	4.3
Sulphur Mines	22	-	-	-
Subtotal	244	57.0	48.9	105.9
Tanks and Pipelines	4	1.2	0.7	1.9
Total	248	58.2	49.6	107.8

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*High sulfur content
+Low sulfur content

Source: Department of Energy, Strategic Petroleum Reserve, Annual Report, February 16, 1981

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TABLE IV-8

CRUDE OIL RECEIVED INTO THE SPR THROUGH 1980

Source Country or State	Net Contract Quantity (Million barrels)	Percent of Total (%)
Mexico	33.1	30.7
Alaska	0.7	0.6
North Sea (U.K.)	23.7	22.0
California (Elk Hills)	0.6	0.6
Libya	15.9	14.7
Nigeria	5.6	5.3
Iran	18.2	16.9
Dubai	1.5	1.4
Saudi Arabia	3.7	3.4
Venezuela	1.0	0.9
Ecuador	0.3	0.3
Algeria	1.5	1.4
Norway	2.0	1.8
Total	107.8	100.0

Source: Department of Energy, Strategic Petroleum Reserve, Annual Report, February 16, 1981

V. ACCELERATING THE STRATEGIC PETROLEUM RESERVE FILL RATE

The Department of Energy has stated:

> Currently, the SPR can provide a limited response to a petroleum supply disruption. Although the capability exists to draw down the Reserve up to a rate of 1.7 million barrels per day, the current oil inventory limits the maximum drawdown to a million barrels per day for 3½ months or about 16 percent of average daily U.S. net petroleum imports during a comparable period in 1980. *

Juxtaposed to the current status is the Congressional Budget Office's estimates of the cost of an oil supply interruption and the benefits of the SPR:

> ...a year-long national shortfall of 2 million barrels per day in 1984 could reduce GNP by about $146 billion dollars (3.6 percent of projected current dollar GNP). Such a shortage could also increase the unemployment rate by about 1.1 percentage points and the inflation rate by about 7 percentage points. Virtually the entire impact of such a shortfall on the GNP and unemployment, as well as a large part of the inflationary effect, could be averted by a reserve of about 750 million barrels. Similarly, a reserve of 1 billion barrels could almost completely offset the impacts of a year-long shortfall of 3 million barrels per day in 1984, which would otherwise cause a $226 billion loss in 1984 GNP, and increase the inflation and unemployment rates by about 15 percentage points and 1.8 percentage points, respectively. . . .[A]barrel of SPR oil could avert about $200 of potential GNP loss in the event of such a 1984 supply interruption. The 1 billion barrel reserve could also offset a complete cutoff of current levels of imported oil for almost a half a year. **

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*U.S. Department of Energy, Strategic Petroleum Reserve, Annual Report, February 16, 1981.

**Congressional Budget Office, Draft Memorandum on Strategic Petroleum Reserve Financing Options, February 6, 1981. Memorandum cites findings of Congressional Budget Office, An Evaluation of the Strategic Petroleum Reserve, June 1980.

As discussed in Section IV, however, the capacity of the salt caverns will equal only 400 million barrels at the beginning of 1985, and will not reach 500 million barrels until the end of 1986. Acceleration of the leaching process to add more storage is limited by system designs and facilities that are in place or are under construction.

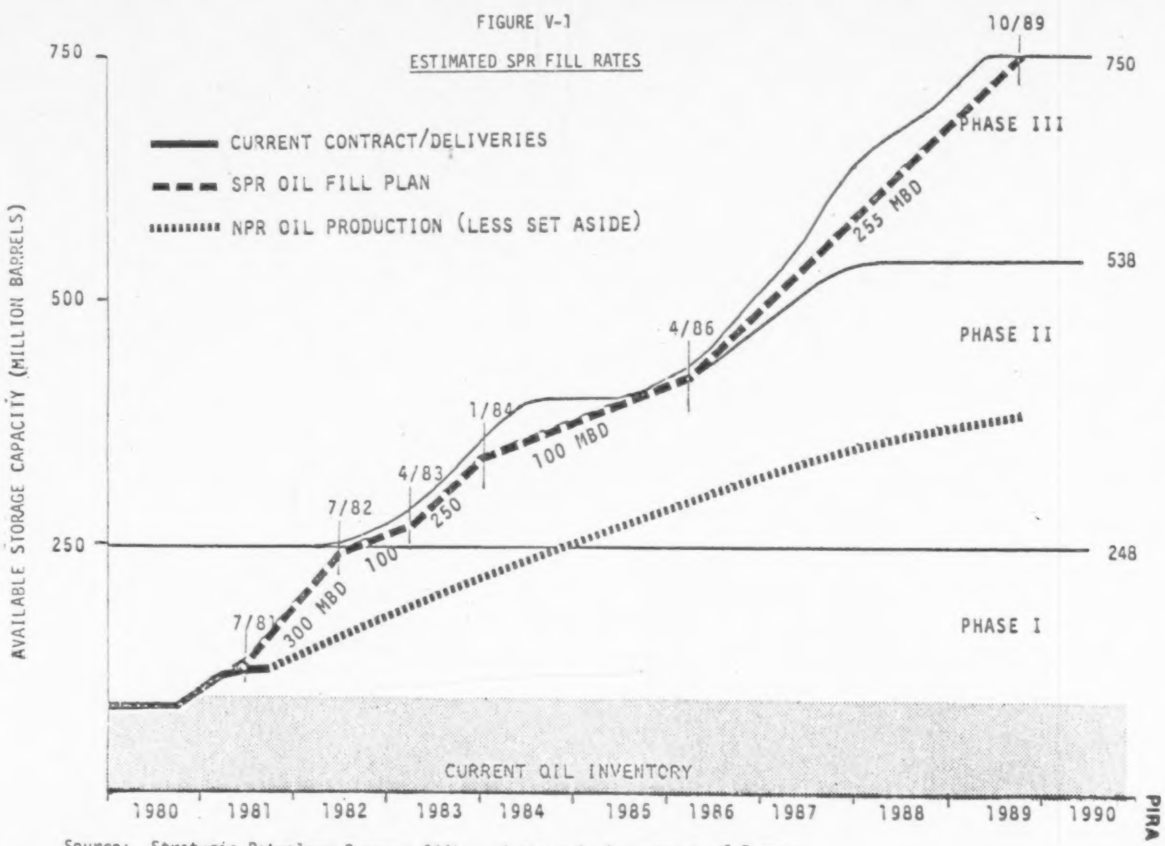
Once facilities are in place, it is extremely difficult to accelerate the leaching process. The most practical way to increase the leaching rate is to modify the system design and retrofit the equipment. Retrofitting necessitates increasing the size and number of injection wells. The size of the freshwater injections and brine disposal pipelines would have to be increased along with pump size and brine holding/settling ponds.

The maximum SPR oil fill rate is limited by (1) the rate at which salt cavern capacity is added and (2) the level of fill in individual salt caverns.

Sustained daily oil fill rates estimated by the Strategic Petroleum Reserve Office are illustrated in Figure V-1. From mid-1981 to mid-1982 the maximum SPR fill rate can be 300 M B/D. During late 1982 and early 1983 the maximum feasible fill rate will be reduced to 100 M B/D and then will temporarily accelerate to 250 M B/D. From 1984 to mid-1986 the SPR oil fill rate will be limited to 100 M B/D. After Phase II capacity is completed and Phase III capacity is brought onstream the SPR fill rate can be increased to 250 M B/D.

FIGURE V-1

ESTIMATED SPR FILL RATES



Source: Strategic Petroleum Reserve Office of the U.S. Department of Energy

At a fill rate of 300 M B/D, the target rate set by the Congress, the SPR will reach a capacity constraint by mid-1982. The fill rate constraints are important both because they preclude the early storage of larger volumes of oil and because they reduce the flexibility to take advantage of petroleum market conditions.

Since 1973, there have been periods when weakness in petroleum markets has caused spot crude oil prices to fall below official sales prices, as they did for some crude oils during 1975-1978. Spot prices are currently well below official sales prices for most crude oils. The low prices have been reflected in SPR purchases over the last several months. In fact, the Defense Fuel Supply Center has requested and received downward price adjustments in some of its SPR supply contracts.

While the salt cavern system is the cheapest alternative for long term storage of strategic stocks, the system and plan for its development are relatively inflexible, as noted earlier. The existence of a substantial reserve at an early date may act as a deterrent to the use of oil as a political weapon. Distributed during a shortage, the crude oil will dampen spot market price increases by removing the necessity for hoarding and panic buying. Its distribution can be controlled in such a way as to minimize the economic loss from a physical shortfall. Achievement of equity among regions, equity among companies, shifts in the available product mix, and meeting U.S. obligations to the International Energy Agency, while competing goals which must be weighed against each other to some extent, will be facilitated by the existence and use of SPR stocks. Further, the lack of flexibility will preclude the possibility of taking advantage of weak market conditions to fill the reserve with minimum disruption of world markets for the lowest oil cost.

The need for augmented storage capability is a relatively short term phenomenon--the completion of Phase II facilities, with their higher fill rates, is scheduled for the end of 1986, and fill rate constraints are eased temporarily at various times throughout the Phase II development. In the remaining sections of this report, we will analyze the economics of alternative, short term storage systems, specifically tankers and steel tanks.

VI. THE USE OF TANKERS FOR INTERIM SPR STORAGE

Tankers have been used increasingly for the storage of petroleum by governments and private oil firms. They offer the advantage of flexibility for interim storage: they are available in abundant supply, can be chartered on flexible terms, can be moved from one location to another, and return to the owner's control at the expiration of the charter. The largest tankers offer the least-cost alternative, because the market for these tankers is in significant surplus, because their larger capacity reduces the logistical difficulty of contracting for and storing large volumes of oil, and because their size leads to substantial economies of scale in acquisition and operating costs.

If tankers were chosen as an appropriate interim storage alternative, they could be chartered for periods ranging from two to five years. The charter could be structured so that tanker operators remained responsible for vessel operations. Vessels could load oil at export ports and steam to predetermined locations, or they could be placed unladen at the storage location and receive the oil by lightering from other tankers.

If necessary, for example in the event of an oil supply emergency, the tankers could be moved from the storage locations to U.S. refining centers, such as the Gulf, East, and West Coasts. Given U.S. port capacity limitations, a large tanker may need to be lightered at sea by smaller tankers, a procedure employed routinely by the oil industry, or moved to a facility able to discharge VLCC's such as LOOP. When the SPR caverns are able to accommodate an increased fill rate, the crude oil could be transferred into the SPR's permanent facility appropriate for the specific crude oil stored.

A. Status of the World Tanker Fleet

The world tanker fleet includes 3,139 vessels with a total capacity of 324 million deadweight tons (dwt). The fleet is stratified into small and intermediate size crude and refined products tankers, large tankers and super-sized crude carriers known as VLCC's and ULCC's*. Generally the smaller ships are employed on short haul trades while the larger vessels (VLCC's and ULCC's) are used on long hauls such as the Persian Gulf to Europe. A tabulation of the world tanker fleet is presented in Table VI-1 below.

TABLE VI-1

COMPOSITION OF WORLD TANKER FLEET, END-MARCH 1981

Size Category (dwt)	Number of Vessels	Capacity (Millions of dwt)	Category's Capacity as % of Total
10- to 49,999	1,362	36.1	11.1
50- to 99,999	732	53.2	16.4
100- to 174,999	329	43.4	13.4
175- to 224,999	115	24.4	7.5
225- to 299,999	487	124.4	38.4
300,000 or more	114	42.1	13.0
Total	3,139	323.7	100.0

Note: Data may not add due to rounding.
Source: H. P. Drewry (Shipping Consultants) Ltd., Shipping Statistics and Economics.

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*VLCC, very large crude carrier; ULCC, ultra large crude carrier. Unless otherwise specified, "VLCC" as used in this report refers to any vessel of 175,000 dwt or more.

Tankers in the 10,000 to 99,000 dwt size category currently number 2,094 vessels and account for 28 percent of the fleet tonnage. Intermediate vessels (100,000 to 174,999 dwt) represent approximately 13 percent of fleet capacity. The 718 supertankers, those with 175,000 dwt capacity or more, account for nearly 60 percent of total fleet capacity.

Since the mid-1970's there generally has been substantial excess capacity in the world tanker fleet. This phenomenon was brought about by (1) the sharp decline in the growth rate of oil consumption in the industrialized countries, (2) increased oil production from fields located closer to major consuming centers (i.e. North Sea, Alaskan North Slope, Mexico) and (3) pre-1974 tanker construction contracts that were predicated on yearly oil consumption increases above 5 percent. The combination of reduced crude oil requirements coupled with the large volume of new tanker deliveries in the mid-1970's has resulted in a long-term tonnage surplus.

Surplus tanker capacity is evidenced in vessel lay-ups, slow steaming, excess port time and partial cargo carriage. According to some estimates, the 1980 world tanker suprlus, taking account of each of these factors, was in excess of 100 million dwt*. Approximately one-third of the VLCC fleet, or 60 million dwt, is estimated to be currently in surplus.

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*See, for instance, John I. Jacobs & Co., Ltd., World Tanker Fleet Review 1980.

It is expected that the VLCC tonnage surplus will continue well into the 1980's. The OPEC price increases of 1979/80 helped to reduce world petroleum demand through lower levels of economic activity, increased conservation and fuel substitution (i.e. by coal, gas, nuclear). Reductions in oil consumption immediately lower OPEC crude requirements in favor of indigenously produced supplies. This phenomenon has had a disproportionate impact on the demand for tankers (VLCC, ULCC) that are used to transport the long-haul crudes.

B. Current Use of VLCC's for Oil Storage

Tankers have been utilized in refining areas, consuming countries, and producing countries to augment storage capacity in the short and medium term. The tanker capacity involved fluctuates from month to month, as charters expire or companies add to or draw upon their crude oil stocks. In recent periods, the tonnage used for storage has varied from 8 to 20 million dwt. Table VI-2 presents a compilation of tanker capacity, most of which is accounted for by VLCC's, dedicated to oil storage as of April 30, 1981. Excluded from these figures may be some tonnage chartered for very short term storage.

The Japanese government is using VLCC's for interim storage of its strategic crude oil stocks. A recent trade publication put the charter costs of Japanese VLCC's at from $2.00 to $2.80/dwt/month or between $6 and $7 million annually per 250,000 dwt vessel, including all operating costs. In Japan, 26 VLCC's are currently

TABLE VI-2

TANKER CAPACITY DEDICATED TO STORAGE, END-APRIL 1981

	VLCC's		Non-VLCC's		All Vessels	
Tanker Location	No. of Vessels	Total Capacity (000 dwt)	No. of Vessels	Total Capacity (000 dwt)	No. of Vessels	Total Capacity (000 dwt)
Japan:						
Off Iwo Jima	17	4,454	-	-	17	4,454
Tachibana Bay	9	2,140	-	-	9	2,140
Total Japan	26	6,595	-	-	26	6,595
Other Far East	6	1,526	8	771	14	2,297
Gulf Coast/Caribbean	5	1,762	2	182	7	1,944
West Africa	1	277	5	385	6	662
Middle East	1	256	4	124	5	380
Total, Outside Japan	13	3,821	19	1,461	32	5,283
Total, All Regions	39	10,416	19	1,461	58	11,878

Source: Lloyd's Shipping Index, April 30, 1981 under charter for strategic storage, most of which drift off Iwo Island, and some of which are anchored in Tachibana Bay. The total capacity of the VLCC's is 6.6 million dwt. According to published reports, the program is now being expanded to as many as 35 vessels.

The use of tankers for storage is common in other parts of the Far East as well. At the end of April, 6 VLCC's and 8 smaller tankers were being used for storage in the area, including Indonesia, Malaysia, and the Philippines. The total tanker capacity of these vessels was 2.3 million dwt.

Another regional aggregation of tankers dedicated to storage is spread across the Caribbean and U.S. Gulf Coast. Owned by private oil companies, the storage is relatively short term (2 to 6 months). The oil storage reflects individual company crude supply situations which fluctuate with market conditions. As such, the tanker storage does not constitute a formal reserve. However, crude movements into the Caribbean/Gulf Coast region are usually destined for U.S. markets and reflect available crude stocks. As shown in Table VI-2, seven tankers were positioned in the area at the end of April, equal to 1.9 million dwt.

A further indication of the current interest in the use of tankers for storage is May chartering figures. According to one industry source, 28 VLCC's were chartered in May with a storage component or option in the fixtures. The duration of the storage charters ranges from less than a month to 9 months, and the tanker capacity involved is 7.9 million dwt. It is interesting to note that 20 of these vessels, accounting for 5.7 million dwt, were chartered by Aramco shareholders (Exxon, Mobil, Standard of California and Texaco), a reflection of these companies' need to dispose of Saudi crude oil in excess of their current requirements.

C. Vessels Available for the U.S. SPR

In order to capture the potential economies of scale, the SPR would have to utilize large tankers. Vessels having a capacity of 175,000 to 299,999 dwt can be classified as VLCC's; those with a capacity of 300,000 dwt or more are classified as ULCC's. The majority of the large tankers are VLCC's. As shown earlier in Table VI-1, tankers with capacity ranging from 175,000 to 299,999 dwt account for 78 percent of the total tonnage of all vessels with capacity of 175,000 dwt or more.

The crude oil carrying capacity of a given vessel varies with the particular crude oil's gravity. For convenience, we have chosen throughout to use a conversion factor of 7.5 barrels of crude oil capacity per deadweight ton, approximately the rate for a 34° API crude oil such as Arabian Light. SPR crude oil Type I, III, and IV could have a similar gravity. At its upper gravity specification bound, SPR crude oil Type II (the lightest SPR category) would be equal to nearly 8.0 bbls/dwt, and at its lower gravity bound, SPR crude oil Type VI (the heaviest) would be equal to 7.1 bbls/dwt. A vessel's capacity to carry cargo is assumed to equal to roughly 97 percent of its rated dwt capacity. Thus, a 175,000 dwt vessel could carry approximately 1.27 million barrels and a 300,000 dwt tanker could carry 2.2 million barrels of a 34^{0} API crude oil. The average capacity of the world tanker fleet above 175,000 dwt now is close to 270,000 dwt.

Currently there are 9 U.S. flag, non-Jones Act* VLCC's with a total capacity of approximately 2.4 million dwt. These ships generally are used in U.S.-foreign trade although a special rule allows that the non-Jones Act VLCC's can be used for domestic shipments of Alaskan oil on a temporary basis if Jones Act vessels are unavailable. Some of these 9 tankers are engaged in the carriage of SPR crude oil and a few may be available for use in an SPR storage fleet.

The larger "Jones Act" fleet consists of mostly small tankers. The average size of Jones Act tankers is approximately 50,000 dwt, in contrast to the average size in the world fleet as a whole, which is over 100,000 dwt. Used under statutory protection for trade between U.S. ports, the tankers have been sized to meet the draft restrictions prevalent in the U.S. Historically, the primary use of these tankers in the petroleum trade was the shipment of products between the refineries concentrated on the Gulf Coast and the East Coast consuming areas. The two deepest ports in these two areas are Portland, Maine, and Hampton Roads, Virginia, which can each take a fully laden 80,000 dwt vessel (maximum). Most other ports in these regions are limited to 35-50 thousand dwt vessels, fully laden.* The larger Jones Act vessels are used on the West Coast, where draft restrictions are less stringent. Shipments from Valdez to West Coast refineries or to Panama for transshipment through the Canal to Gulf Coast refineries have been an important, protected market for these larger Jones Act tankers, and will continue to be so. In addition, smaller Jones Act tankers ranging from about 35,000 to 90,000 dwt are currently being used for the shipment of Alaskan crude oil through the Panama Canal to the Gulf Coast. It is unlikely that the small Jones Act tankers would be attractive economically for SPR storage, and the larger Jones Act tankers face a stabler market and are not expected to be available.

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*The "Jones Act" is the common term for the Merchant Marine Act of 1920, which prohibits foreign-built, -owned, or -operated ships from engaging in trade between U.S. ports. Also excluded from these routes are U.S.-built, U.S.-flag vessels which were built with construction subsidies from the U.S. Maritime Administration, such as the nine VLCC's mentioned.

The major portion of an SPR storage fleet would thus likely be foreign-built VLCC's. The depressed market for these tankers has been indicated by scrappings in recent months. Scrapping represents an alternative for any tanker owner, and prices for scrapping therefore give an indication of the capital cost on which a charter for SPR storage may be based. Scrap prices are based on a price per light displacement ton (ldt), a measure of the amount of steel in a tanker. The ratio of ldt:dwt is not constant, but varies by tanker size and characteristics.

Scrapping prices are volatile, reacting quickly to tanker rates (and thus the number of tankers on the market for scrapping) and to steel prices. In the November 1980-March 1981 period, the price of VLCC's for scrap ranged from $167-$185/ldt. It is instructive to note that in April, a VLCC was scrapped for $138/ldt, a drop of approximately 20 percent. The gross sale price for this particular vessel was $4.5 million or $20.40/dwt. In April, the prices of six other VLCC's sold for scrap ranged from $4 to $6 million. In May, similarly, a VLCC sold for $133/ldt, equal to a total cost of $4.3 million or a cost per dwt of $21.13.

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*See, for instance, National Petroleum Council, Petroleum Storage & Transportation Capacities, Vol. V: Waterborne Transportation, December 1979.

D. The Economics of Using VLCC's for Storage

The costs of using large tankers for interim strategic petroleum storage will depend upon a variety of factors, including the condition of the VLCC market in any given period, and the choice of locations and ship configuration to be used. Since the great majority of transactions would involve direct negotiation between the U.S. agencies and current vessel owners or charterers, any generalization may be off the mark when compared with individual vessels of widely varying size and operating characteristics. Tanker owners and operators, bidding for a storage contract, will present the government with an array of costs and contract terms. Each will use a valuation methodology which reflects the use alternatives for their individual vessels within the context of the then-current tanker market as a whole. It is assumed that vessels are crewed by U.S. citizens for security reasons and otherwise meet stringent existing U.S. tanker safety standards. Thus, to attract vessels into the program, charter hire will have to equal or exceed the rates paid in the world market for storage tankers, after taking into account full U.S. costs. In recent months, the daily cost of VLCC's used for short-term storage has ranged from $12,000-$13,000 per day, not including a provision for fuel expenses while pumping.

Because of the disparate impacts of the factors mentioned above, it is impossible to quantify here the cost of VLCC's for interim SPR storage. By way of illustration, however, we have included as an Appendix to this report one estimate of tanker storage costs, which uses as a basis for valuation the acquisition of tankers. While few purchases of second-hand VLCC's are expected to be made specifically for the purpose of chartering into the SPR program, the methodology represents one facet of the market's perception as to the future income producing capacity of large tankers. The result of our calculations, a VLCC storage cost of $2.64 to $3.16/Bbl per ship annually, are roughly in line with those currently reported for the Japanese storage program. The estimate is also consistent with the recent fixtures for short-term storage mentioned earlier.

Although we have not undertaken an examination of the price elasticity of supply of the VLCC market and thus cannot quantify the effect the removal of these vessels from the market would have on tanker rates, it seems clear that rates should increase. The precise quantification of tanker rates becomes less important for this analysis and for a decision to utilize tankers for SPR storage if one bears in mind that the vessel charters are negotiated ship-by-ship; no commitment need be made which precludes response to the dynamics of the tanker market.

E. Other Considerations

As noted earlier, the maximum feasible fill rate for the SPR salt caverns is systemically constrained in the period to 1986. According to the estimates by the Department of Energy's Strategic Petroleum Reserve Office, shown in Section V, the maximum fill rate, while varying over the period, will average 130 M B/D between the third quarter of 1982 and the first quarter of 1986. If a decision were made to accelerate the fill rate to the Congressional target of 300 M B/D over this period, for example, augmented storage capacity needs for the additional 170 M B/D would amount to approximately 230 million barrels by the Spring of 1986. A lower illustrative fill rate, say 215 M B/D, or 85 M B/D in excess of the caverns' acceptance capacity, would create additional storage needs for approximately 115 million barrels by the Spring of 1986. At an assumed VLCC capacity of 1.964 million barrels per vessel, the higher rate would require the use of 117 vessels by April 1986, and the lower rate would require 59 vessels. It should be noted, however, that the postulated additional storage needs calculated above are not constant, but grow over time to a peak in 1986 and then fall.*

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*The reduction in the need for additional storage is not so precipitous as might be assumed. At the sustainable fill rate of 255 M B/D projected for the second quarter 1986 onward, it would take over 900 days to transfer 230 million barrels of oil from interim to permanent storage. During this period, however, the benefits of reduced vulnerability would remain.

We have not dealt in this paper with the many technical questions involved in stationing a large number of stationary VLCC's for long periods in the U.S. Gulf/Caribbean area. Once the concept is found to be an attractive option, given the salt dome storage bottleneck, these matters, including questions of location, safety, and operation should be carefully studied. Again, the use of large tankers for temporary and medium-term storage facilities now is a well documented fact of international commerce in petroleum.

VII. THE USE OF STEEL TANKS FOR INTERIM SPR STORAGE

As is the case with tanker storage, there is no doubt that the use of steel tanks for the SPR is more costly than total reliance on salt caverns. If a decision were made to augment SPR capacity in the short term, however, steel tanks would present another option for interim storage. The government's alternatives would include leasing or purchasing existing tanks or contracting for the construction of new tanks.

A. Existing Steel Tank Capacity

The availability of significant volumes of existing tank capacity for lease or purchase is uncertain. There are several reasons, in addition to the current observed unavailability of tankage, that existing facilities will not fill the need for interim SPR capacity. First, the volume of additional capacity is far greater than any estimate of the volume that could be made available. The total shell capacity of crude oil storage tanks is somewhat less than 475 million bbls, while the interim storage needs could be 100 to 200 million bbls. Secondly, the removal of significant commercial storage capacity from the industry network will directionally discourage the holding of private excess inventory, precisely the opposite effect from that desired of any SPR policy.

In 1979, in its report on storage capability, the National Petroleum Council (NPC) concluded that "no significant storage capacity exists for holding emergency supplies."* The conclusion was based on an analysis of the tankage necessary to keep flexibility in the system, unavailable inventory such as tank bottoms, and unavailable capacity such as tank tops. The NPC supported its conclusion with the observation that the industry's average utilization of tank capacity over the period 1948-1978 was approximately 50 percent. After the exclusion of tank tops and tank bottoms, the remaining ullage is required for system flexibility. The crude oil storage capacity utilization is currently even higher than the level reported by the NPC in September 1978.

Because a goal of any SPR interim storage program would be increased flexibility, there is no reason to rely on one system exclusively. If the tanker market displays particular price sensitivity to incremental chartering activity, for instance, the lease or purchase of existing tanks could prove an attractive marginal complement to a tanker storage program. The closing of refineries, particularly facilities along the Gulf Coast, is an expected result of prevailing market forces. These refineries could have unused crude storage capability. This capacity, while not large enough to serve as the only depository of an accelerated SPR fill rate, may be available at economic rates.

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*National Petroleum Council, Petroleum Storage & Transportation Capacities, Volume II: Inventory and Storage, December 1979.

B. Cost of Steel Tank Construction

Under any circumstances it is likely that the major portion of tankage used for SPR interim storage would have to be constructed. Officials of the Department of Energy's SPR Office indicate that the capital cost of steel tanks ranges from $8 to $20 per barrel of capacity, with a mean value of $15 per barrel. The wide variations in cost estimates reflect size, location, soil conditions, environmental regulations, and whether the facility was a grassroots design or an extension of an existing tank farm.

In a 1979 proposal to the SPR, Chicago Bridge and Iron (CBI) suggested the construction of a 40 million barrel tank farm, located in Louisiana, using SPR terminals and pipelines and including 32 tanks with individual capacities of 1.25 million barrels. CBI estimates that a 40 million barrel tank farm would take two to three years to construct and cost approximately $360 to $420 million, or $9.00 to $10.50/bbl of capacity.

The CBI estimate (made in 1979) was adjusted to reflect inflation-related cost increases over the 1979-81 period (see Table VII-1).

TABLE VII-1

ESTIMATED CAPITAL CONSTRUCTION COST OF A 40 MILLION BARREL CRUDE OIL TANK FARM

(Millions of 1981 Dollars)

Engineering, Permits and Environmental Impact Statement	$2.8
Land Acquisition	7.4
Earthwork, Foundations, Dikes and Drainage*	84.0 - 140.0
Tank Construction	187.6
Piping System within the Tank Farm	84.0
Total	365.8 - 421.8

*Higher end of range assumes piles are required.
Source: Chicago Bridge and Iron estimates.

C. Comparison of the Cost of Alternative Storage Facilities

For a comparison of the cost of alternative storage systems, we have converted all data to a more consistent basis. The cost of SPR cavern facilities shown in Table IV-5 (p. 31) and the cost of new steel tanks shown in Table VII-1 (p. 55) have been amortized over five years, and a 15 percent annual rate of return has been included. The cost of tanker storage has been taken directly from the Appendix, Table A-1 (p. A-6). The result is shown in Table VII-2 below. The use of a five year amortization overstates the cost of the salt caverns, because their useful life, and thus their financial evaluation, is in fact based on a much longer time frame. In addition, the Government's expenditures for the salt caverns are not simultaneous, but in smaller increments than would be suggested by our calculation.

TABLE VII-2

ESTIMATED ANNUAL COST OF OIL STORAGE IN ALTERNATE SYSTEMS

	$/Bbl
VLCC's	2.64-3.16
New Steel Tanks	3.20-3.69
SPR Salt Caverns	
Phase II	0.85
Phase III	1.67

Sources: VLCC's: Table A-1.
New Steel Tanks: Table VII-1, adjusted as per textual reference above.
SPR Salt Caverns: Table IV-5, adjusted as per textual reference above.

In terms of cost per barrel of storage capacity, the salt cavern system remains the least expensive. The annualized capital costs of Phase II and Phase III facilities are $0.85 and $1.67/Bbl, respectively. Of the two cases we have examined, the use of tankers has an annualized cost ranging from $2.64 to $3.16/Bbl, dependent on the acquisition costs. The annualized capital cost of new steel tanks is $3.20-$3.69/Bbl, or generally above the higher tanker costs. It should be noted that the steel tank construction costs are predicated on a specific proposal for a 40 MM Bbl tank farm at the Gulf Coast, which falls at the low end of other estimates of the cost of new steel tanks. Smaller tank farms, and tank farms in locations that require site-specific modifications of this estimate, would carry a significantly higher cost. In addition, the steel tank farm costs exclude fixed operating costs such as property taxes and insurance. These fixed operating costs for dead storage at the Gulf Coast would add approximately 10% to the construction costs shown here, according to some estimates.

Thus, there is no question that salt caverns require the lowest capital outlay for SPR storage. The continued vulnerability caused by a lack of a large SPR and the inflexibility caused by the caverns' fill rate constraints bear a cost as well. The use of interim storage, while requiring a larger capital outlay per barrel of oil stored, offers an alternative which reduces these costs and should be explored and evaluated in light of the strategic importance of the Reserve.

APPENDIX: AN ILLUSTRATIVE CALCULATION OF VLCC CHARTERING COSTS FOR THE SPR

As noted in the body of this report, there are myriad methodologies for valuation of a tanker entering the storage market. The costs and contract terms will reflect the then-current VLCC market and other perceived alternatives for tanker owners. The illustration of costs constructed in this Appendix is based on an initial capital outlay (a proxy of an acquisition cost) plus operating cost components.

In our discussions with individuals in the tanker industry, we found a wide variance of opinion as to the specific aspects of positioning, crewing levels, and power requirements which a storage charter might entail. With respect to location, for instance, some insisted that only a sheltered harbor or fjord would be acceptable, while others spoke of allowing the vessel to go dead in the water at sea. Crewing requirements varied from a full complement (some 32 men) to as few as five men, or in the case of grouped vessels, no crew at all on some. Power requirements were premised for some on full steam at all times, while for others they were premised on no power at all on some vessels in a grouped configuration. The range of estimates on these factors is based on individual perception of risk. In order to construct this example, we have chosen a middle ground in the ranges, founded on actual experience. The operating costs we discuss here, therefore, are higher than some estimates and lower than others.

Our example is based on single vessels in "safe anchorages" at sea. The concept of a safe anchorage, essentially a location where weather changes are predictable or give sufficient warning, and where underwater hazards and other vessel traffic are unlikely, is subjective, as noted earlier. The classification of a given location as a safe anchorage is based on the tanker operator's and the underwriter's assessment of risk to the vessel. We have assumed that the tankers in our example would be located in the Gulf of Mexico or in the Caribbean as other vessels are now, outside existing shipping lanes. Off the Gulf Coast, the vessels would likely be outside the 12-mile limit because of water depth constraints. The vessels would carry skeleton crews (roughly 20 men) and would run diesel generators for shipboard energy. The main power units would be kept on "hot stand-by" to assure the ability to move quickly in case of emergency.

A. Capital-Related Costs

Estimates of the capitalized vessel cost upon which a charter is partly based has been divided into two cases. Because it is possible that the chartering of vessels for the SPR program could have an impact on VLCC freight rates through reduction of the surplus, it seems reasonable to assume that the earlier charters may be more economical than later charters. For illustrative purposes, therefore, we have calculated capital costs based on "acquisition" costs of \$5 million and \$8 million per vessel. The \$5 MM initial capital cost reflects both the depressed freight rates at present and the currently low scrap prices, and thus is probably a minimum estimate. Further, the $8 MM capital cost is used here for illustration, and is unlikely a maximum estimate. We recognize that movements in tanker rates will occur and that not all of the vessel storage capacity is likely to be chartered within the illustrative range of costs. Preparation and positioning costs totalling $2 million should be added, a rough estimate that might include the cost of drydocking prior to the commencement of the charter for maintenance and antifouling treatment to reduce marine growth on the hull (now a routine on most VLCC's). Some tanker operators might choose to install an additional diesel generator in order to obviate the need to draw power for shipboard energy from the main boilers; this too is apparently relatively common.

Total capital costs of the VLCC's then become $7 million and $10 million per tanker. Under an assumed five-year payout calculation, 40 percent of the capital would be recovered over a two year charter, the approximate period used by the Japanese in their storage program. With a 15 percent annual interest payment on the declining balance of capital, the amortization and average annual interest expense range from $2.28 to $3.26 million per ship annually during the two years.

We have assumed that foreign flag tankers would not be transferred to U.S. registry. The estimated cost of the transfer, $3 to $5 million per vessel to meet Coast Guard requirements, would significantly affect the economics of tanker use for the SPR. The estimated increase from the figures shown in our calculations for a 270,000 dwt vessel, on an average annual basis, would be approximately $1.00-$1.68 million per ship-year.

B. Operating Costs

Operating costs would be comprised mainly of labor, insurance, and fuel.

1. Labor

Because the VLCC will move only in emergencies, a full crew is unnecessary. Minimum crew requirements are established by the vessel's flag-state as well as operational needs. We have estimated a crew size of about 20 men, which includes the personnel required by most flag-states and those less skilled personnel required to provide services. The total cost for a U.S. crew of this size, including wages, overtime, fringe benefits, etc., has been estimated at $1.9 million per year.

2. Insurance

The cost of insurance is estimated to be $290,000 per year for each of the VLCC's. Included in the estimate is coverage for hull and machinery, crew protection and war risk. Cargo insurance is excluded from the calculation, since the risk of cargo loss would be borne by the government.

3. Fuel

In our example, the diesel generators would burn 2-3 tons of fuel per day in order to provide hotel services for the crew. The main power units, which burn Bunker C, would be kept on "hot stand-by," enabling them to be brought to full power within several hours. In order to assure that rapid start-up capability, the boilers are usually brought to full steam several times per week. Since there is no power draw, however, the fuel consumption for this procedure is nominal. In the event of a weather or other emergency which necessitates moving or maneuvering the vessel, the Bunker C consumption would increase. Based on discussions with a tanker owner/operator experienced with floating storage in the Gulf of Mexico, the short start-up time afforded by this "hot stand-by" technique eliminates the need to maintain the main power units at full power, even during hurricane season. Fuel use in our estimate is some 45 B/D of Bunker C equivalent (having accounted for the price differential between Bunker C and diesel fuel); at $27/Bbl, the annual fuel cost would be some $.45 million. Other fuel use assumptions, such as maintaining the boilers at full power throughout hurricane season, lead to fuel costs about twice as high. When spread over the entire cargo stored, however, the difference is equal to only about 20¢/Bbl of oil stored.

C. Result

Table A-1 summarizes the results of these calculations, per vessel, on an annual basis. Total costs range from $5.2 to 6.2 million, or $2.64 to $3.16/Bbl of oil stored, depending on the initial cost of the ship.

Table A-1

ESTIMATED AVERAGE ANNUAL COST OF OIL STORAGE IN VLCC'S

(1981 Dollars, Per Vessel)

Assumptions

Duration of Charter: two years
Tanker Capacity: 270,000 dwt; 1.964 MM Bbls
Interest Rate: 15 percent

	Initital Cost Assumption			
	$7 MM Vessel		$10 MM Vessel	
	Millions	$/Bbl	Millions	$/Bbl
Vessel Amortization	1.400	.71	2.000	1.02
Interest Expense	.945	.48	1.350	.69
Labor Cost	1.900	.97	1.900	.97
Insurance Cost	.290	.15	.290	.15
Fuel Cost	.443	.23	.443	.23
Miscellaneous Cost	.200	.10	.200	.10
Total	5.178	2.64	6.183	3.16

Source: PIRA

Senator WARNER. Thank you very much. Do you have any views on whether or not the Jones Act would affect the storage vessels in a territory war?

Mr. LUCIANO. Are you referring, Mr. Chairman, to the potential of using foreign flag vessels for interim storage? It is our understanding that foreign oil imports acquired for such interim storage would be subject to the preference laws requiring that at least 50 percent of the oil transported be aboard U.S.-flag vessels.

If the oil came from domestic sources then, in our view, the Jones Act would apply and 100 percent of the oil would be required to be carried in American vessels.

Senator WARNER. Thank you.

I want to thank all who participated in this hearing.

Mr. LUCIANO. Thank you very much.

[Whereupon, at 2:35 p.m., the hearing was adjourned.]

[The subcommittee received the following letter from the Lukens Steel Co.:]

LUKENS STEEL CO.,
Coatesville, Pa., March 2, 1982.

Mr. ROGER A. SINDELAR,
Staff Member, Subcommittee on Energy and Mineral Resources,
Washington, D.C.

DEAR MR. SINDELAR: I understand that your Subcommittee on Fossil & Synthetic Fuels is conducting hearings today dealing with the Strategic Petroleum Reserve. The buildup of this reserve to prescribed levels is important and the method chosen for storage is of particular interest to Lukens.

It is our understanding that the Department of Energy favors salt dome storage for the third phase of the Strategic Petroleum Reserve even though a U.S. Corps of Engineers study, that was requested by D.O.E., cited definite advantages for above-ground steel tank storage. We believe the study results show that above-ground steel storage tanks offer advantages in terms of completion schedules and cost effectiveness.

In addition, above-ground steel tanks proivde flexibility of storage for different refinery runs, incrased dispersal opportunities for better security, job opportunities in a greatly under-utilized steel fabrication industry and needed jobs in the steel industry.

It has been estimated that the construction of above-ground steel tanks will require approximately 420,000 tons of steel plate. The production of this amount of steel plate would require about 1,700 steelworker man-years of work. This does not take into consideration the additional employment in related industries. Our friends in the fabrication and construction industries tell us that the fabrication and erection of the tanks would provide an additional 6,150 man-years of work in their industries. At a time when steel industry employment is at the lowest level since 1933, this potential for employment must be an important consideration in any deliberations regarding the Strategic Petroleum Reserve.

Lukens Steel Company produces only plate steels and plate shapes. Currently, our markets are eroded by unfairly-priced imports and depressed by the general weakness of the economy. Plate imports, in fact, accounted for 31 percent of apparent supply in January. About 700 of our 4,000 employees are unemployed at the present time.

We ask that you seriously consider the advantages of above-ground steel tank storage, including the employment potential, and direct the Department of Energy to proceed with construction in order to expedite the filling of the Strategic Petroleum Reserve.

Sincerely,

ROBERT L. CAHOON,
Vice President, Commercial.

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